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ABSTRACT

The Sullivan Reading Program is designed to teach reading, with the focus on basic skills, to children beginning in kindergarten and continuing through grade 3. It is also used in remedial reading instruction for children and adults of all ages. The two basic series of materials are the Programmed Reading series and the Sullivan Reading Program, accompanied by many supplementary materials. This report describes the rationale, various materials developed and the procedures for using them, the origins and developmental procedures, and the field tests carried out by independent school districts and researchers. It is based upon published materials, documents in the files of the developing agency, and interviews with staff who were involved in the product development. Diffusion, adoption, costs, and critical decisions made during the development are listed. This product development report is one of 21 such reports, each dealing with the developmental history of a recent educational product. References, tables, and appendixes are included. (AW)

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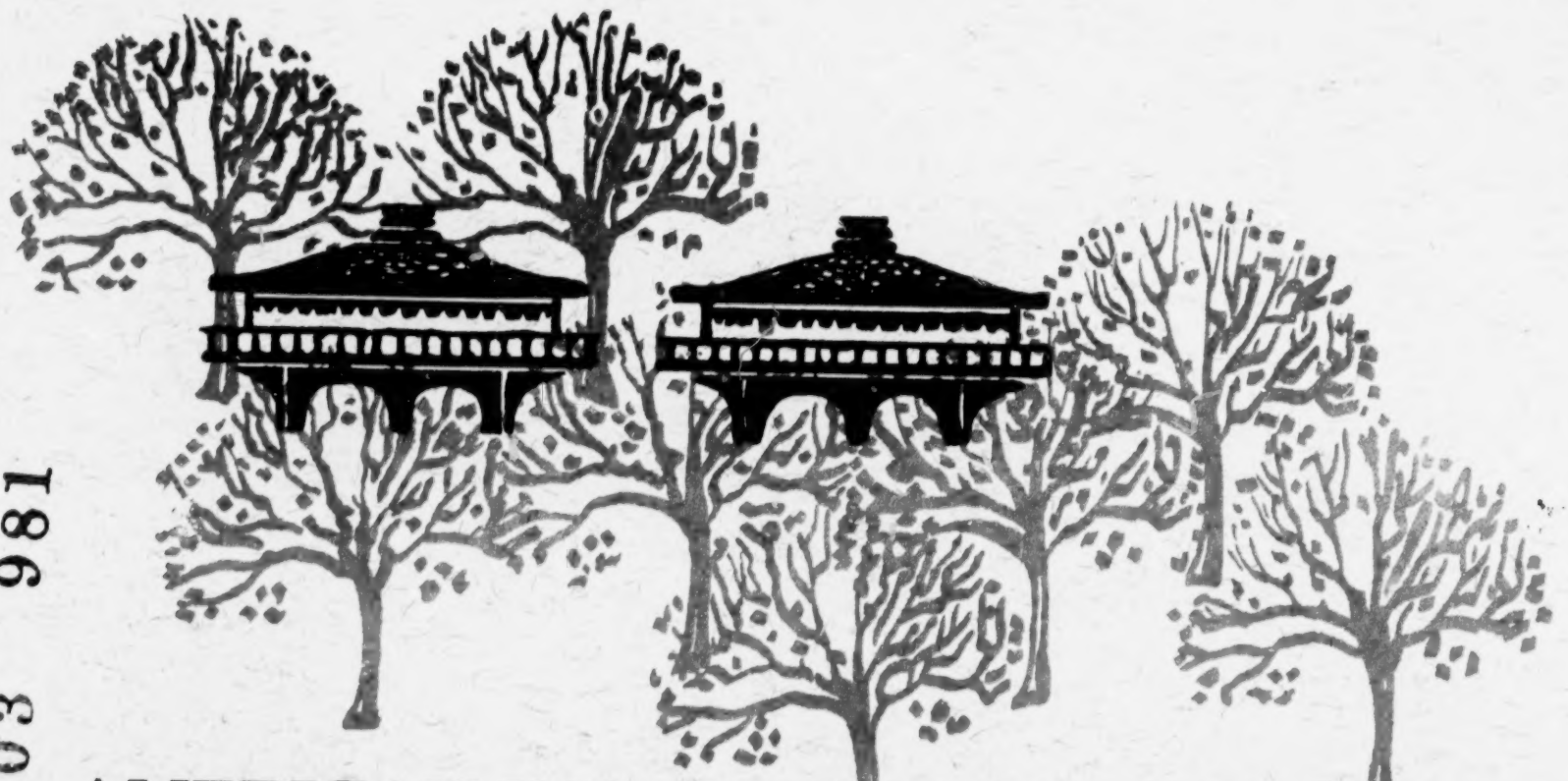
PRODUCT DEVELOPMENT REPORT NO. 5

THE SULLIVAN READING PROGRAM

Developed By Sullivan Associates, Menlo Park, California

November, 1971

Contract No. OEC-0-70-4892



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THE SULLIVAN READING PROGRAM

DEVELOPED BY SULLIVAN ASSOCIATES, MENLO PARK, CALIFORNIA

U. S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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Lorna J. Thompson

American Institutes for Research
in the Behavioral Sciences

Palo Alto, California

November, 1971

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U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education
Office of Program Planning and Evaluation

PREFACE

This product development report is one of 21 such reports, each dealing with the developmental history of a recent educational product. A list of the 21 products, and the agencies responsible for their development, is contained in Appendix D to this report. The study, of which this report is a component, was supported by U.S. Office of Education Contract No. OEC-0-70-4892, entitled "The Evaluation of the Impact of Educational Research and Development Products." The overall project was designed to examine the process of development of "successful educational products."

This report represents a relatively unique attempt to document what occurred in the development of a recent educational product that appears to have potential impact. The report is based upon published materials, documents in the files of the developing agency, and interviews with staff who were involved in the development of the product. A draft of each study was reviewed by the developer's staff. Generally, their suggestions for revisions were incorporated into the text; however, complete responsibility for interpretations concerning any facet of development, evaluation, and diffusion rests with the authors of this report.

Although awareness of the full impact of the study requires reading both the individual product development reports and the separate final report, each study may be read individually. For a quick overview of essential events in the product history, the reader is referred to those sections of the report containing the flow chart and the critical decision record.

The final report contains: a complete discussion of the procedures and the selection criteria used to identify exemplary educational products; generalizations drawn from the 21 product development case studies; a comparison of these generalizations with hypotheses currently existing in the literature regarding the processes of innovation and change; and the identification of some proposed data sources through which the U.S. Office of Education could monitor the impact of developing products. The final report also includes a detailed outline of the search procedures and the information sought for each case report.

Permanent project staff consisted of Calvin E. Wright, Principal Investigator; Jack J. Crawford, Project Director; Daniel W. Kratochvil, Research Scientist; and Carolyn A. Morrow, Administrative Assistant. In addition, other staff who assisted in the preparation of individual product reports are identified on the appropriate title pages. The Project Monitor was Dr. Alice Y. Scates of the USOE Office of Program Planning and Evaluation.

Sincere gratitude is extended to those overburdened staff members of the 21 product development studies who courteously and freely gave their time so that we might present a detailed and relatively accurate picture of the events in the development of some exemplary educational research and development products. If we have chronicled a just and moderately complete account of the birth of these products and the hard work that spawned them, credit lies with those staff members of each product development team who ransacked memory and files to recreate history.

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PRODUCT DESCRIPTION

Product Characteristics

Name

The Sullivan Reading Program.

Developer

Sullivan Associates, Menlo Park, California.

Distributor

Behavioral Research Laboratories, Inc., (BRL) Palo Alto, California. Research, development, and publication have all been accomplished by the same group of people; only their locations and professional affiliations have changed. BRL markets most of the reading materials, although some are distributed by the Webster Division of the McGraw-Hill Book Company.

Focus

The Sullivan Reading Program focuses on the basic skills of reading the English language.

Grade Level

Kindergarten-grade 3 primarily, but see Target Population, below.

Target Population

Designed to teach reading to all youngsters beginning in kindergarten or first grade and continuing through the primary years, the Sullivan materials are also used in remedial reading instruction for children and adults of all ages.

Rationale for Product

The Sullivan Reading Program is the work of Dr. M. W. Sullivan, a few of his colleagues, hundreds of assistants, and thousands of children who wanted to learn to read. Dr. Sullivan strives to teach all children to read, to read well, and to read with enjoyment and satisfaction. His materials approach this task through linguistics, development of decoding skills, and a programmed format that both stimulates and reinforces the child in his efforts to read. Applying the tenets of both learning theory and linguistics, Sullivan concluded that standard methods of teaching

reading were making the subject much more difficult than it needed to be. Accepted learning theory states that learning is accomplished by the responses of the pupil to what is presented, not in the mere reception of information. Secondly, learning theory states that for learning to be efficient, a pupil's response must be immediately corrected if the response is wrong, or immediately reinforced or rewarded if it is right. A third principle is that all pupils do not learn at the same rate; to maximize learning for each student, each should be allowed to progress at his own rate rather than be prodded or kept in check to work at the same pace as the group as a whole. The field of linguistics provides a completely new schedule for teaching the sounds and words of English--a schedule designed never to fool or trick the child by the early presentation of words having few or no phonetic analogues.

Description of Materials

The Sullivan Reading Program actually consists of several different series of materials, each with a different name and different purpose. The backbone of the materials is made up of two basic series, the Programmed Reading series and the Sullivan Reading Program. Many supplementary sets of materials, including reading readiness materials, enrichment activities, and tapes have been produced to accompany and enhance the two basic series. The materials may be used and purchased in any combination, depending upon user needs. At this time, the number and variety of Sullivan reading materials are increasing at a steady pace; consequently, there are components of the Sullivan program that are not discussed here. The major products under consideration in this report are described below.

Readiness in Language Arts Program, by C. D. Buchanan and M. W. Sullivan, is entirely teacher administered. This program prepares children for the formal reading program by teaching directions, spatial concepts, colors, the alphabet, and one sound-symbol relationship for each letter. Materials include six Giant Books with color pictures, six teacher's manuals giving step-by-step directions, two alphabet strips (small letters and capitals), and an easel and case to present and pack the materials. The cost of this program is $199.95.

Enrichment Materials Kit for Readiness in Language Arts, by C. D. Buchanan and M. W. Sullivan, is designed to accompany the program above.

These materials allow the children to use and review what they learn in the Readiness Program. The kit includes a teacher's manual, three different colorbooks, 90 enrichment cards, a set of letter cards, and three sets of word cards. The colorbooks allow the children to use actively the color discrimination presented in the Giant Books; the enrichment cards are used to initiate discussion of the concepts presented; and the letter and word cards provide oral review of lessons in the Readiness Program. A complete set for 30 pupils costs $69.95.

The I Can Read series, by Sullivan Associates, consists of eight readers that pupils are capable of reading alone, during and immediately after the Readiness Program. The complete classroom set of five copies of each of the eight readers costs $49.95.

Reading Readiness prepares pupils for entry into the Sullivan Reading Program by teaching printed numbers and letters, sound-symbol relationships, and a few words. Book A is teacher administered, Book B reviews Book A concepts and gives the child his first opportunity to work individually at his own speed; Book C presents review and new letters and words; and Book D introduces syntactic patterns (e.g., article-noun pattern) and teaches new letters and words. Six Reading Readiness Readers supplement the program by providing enjoyable reading the child can master. A Teacher's Manual and Placement Examination are included in the program which costs $16.38 for one of each.

The Sullivan Decoding Kit is designed specifically for the first grade pupil and can be used to augment the basal reading series. Word cards show on one side a picture and its corresponding noun and on the other side the noun alone. One copy each of Books A, B, C, and D from the program above and their accompanying teacher's manual are included. An alphabet chart and a second teacher's manual giving step-by-step instruction for use of the kit are included. Materials for 30 pupils cost $199.95, and a single kit is priced at $49.95.

The Sullivan Reading Program, by M. W. Sullivan, is designed to help children who have reading problems. The program is divided in five numbered series, each corresponding roughly to one school year. Series 1 and Series 2 each consist of four programmed texts ($1.49 each) wherein the child experiences continuous success in small, easy tasks, is reinforced constantly for

correct answers, and proceeds easily from known information to new information. Twelve readers ($.99 each) accompany the texts in each series. Series 3 has four texts and four readers; Series 4 and Series 5 each have just the four texts. A teacher's manual ($.99) and a test booklet ($.49) are included in each series. Supplementary tapes provided for pupils who need special help cost approximately $18.00 each. A class record book ($.49) allows the teacher to record efficiently pupils' progress from Book A through Series 5. The Behavioral Objectives Manual ($1.49) explains the behavioral objectives achieved by the Reading Program. The placement examination covering the entire Reading Program is priced at $.49.

Programmed Reading (revised edition), by C. D. Buchanan, is composed of a prereading program and three basal reading series. The prereading program for kindergarten and grade 1 utilizes alphabet cards, sound-symbol cards, an alphabet chart, a prereader, and a teacher's guide. Most of the material is presented by the teacher. Series I, corresponding roughly to grade 1, has Programmed Reading Books 1 through 7, 14 accompanying storybooks, a student test booklet, and a response booklet. Series II, generally corresponding to grade 2, has Books 8 through 15 and the same correlated materials as Series I. Similarly, Series III has the same sets of materials using Books 15 through 24 to correspond roughly to grade 3. This program is a basic series, as is the Sullivan Reading Program described above, but Programmed Reading is designed more for general students and less for inner-city pupils than is the other program. Webstermasters (dittomasters) provide seatwork for each series.

Comprehension Readers, by Sullivan Associates, contain stories to enhance and broaden the pupils' reading experience at specific levels. They also contain questions to develop and test the pupils' understanding. Four Comprehension Readers accompany each text in the Sullivan Reading Program Series 1 and 2. Each Comprehension Reader costs $.99, and a complete set costs $23.75.

The Elementary School Reading Laboratory is made up of the components of the Sullivan Reading Program, Comprehension Readers, 30 tape reels, and the Reading Readiness series. The complete laboratory for 100 pupils is priced at $1,995.95, a savings of more than $500 over the price of the included materials when purchased separately.

Project READ, initiated by Behavioral Research Laboratories in 1968, is a systems approach to the teaching of reading; it provides Sullivan reading materials, educational consultants, and a parent information and involvement program. With the exception of the McGraw-Hill Programmed Reading series, all of the Sullivan reading materials discussed in this report are provided as part of Project READ. Teacher training provided with the project includes sending BRL consultants to work with individual teachers, and to demonstrate the most effective implementation of the materials. Throughout the school year, the consultants are available to work with students and teachers. Project READ costs $20 per student for a full year's program, or $15 per student for a one semester or summer session.

Procedures for Using Product

Learner Activities

The uniqueness of the Sullivan materials lies in their programmed format and in the linguistically arranged order in which the letters and words are presented. Information in programmed texts is presented in small, easily mastered steps called "frames." The difficulty of the material progresses very gradually and the order of presentation is carefully logical. In each frame, the pupil is asked to supply an answer to a question or to fill in a blank. As soon as he has responded, he may uncover the correct answer shown in an answer column, which he covers with a "slider" until he is ready to check his own response. Reviews are presented frequently and tests are provided for systematic surveillance of the student's progress.

Behavioral Research Laboratories, publishers of the programmed materials, recommend that other activities be generously interspersed in the periods of using the programmed texts. As BRL's booklet, "Effective Teaching with Programmed Instruction" (1971) states:

> The experiences of teachers and researchers clearly show that an overwhelming majority of students strongly prefer programmed materials to the traditional classroom situation. Nevertheless, a steady diet of programmed instruction is not nearly as stimulating for the student as an approach that involved a variety of educational experiences [p. 5].

To this end, the Sullivan Decoding Kit, Comprehension Readers, Programmed Reading storybooks, and various tapes have been produced. Other enrichment activities planned and recommended by BRL but not discussed in detail here are also available. A reading period might typically include 20 minutes of work in a programmed textbook, 15 minutes of reading a story, and 15 minutes of playing a word game.

Pupils are not presented with the objectives as they are stated in the Behavioral Objectives Manual, but the programmed format insures that students approach and master the objectives in the proper order. The teacher is always aware of what sound-symbol relationships pupils are studying and, consequently, can monitor their success in meeting the objectives simply by observing their progress through the booklets.

One of the major characteristics of the programmed materials is that they allow the pupil to work independently and at his own pace. BRL, to emphasize the individualization of the materials, urges that "under no circumstances should a student be assigned a minimum amount of material to be covered in class" (BRL, 1971, p. 6). BRL does recommend, however, that minimum standards be set so that no student proceeds so slowly that he makes virtually no progress. A slower pupil can be expected to take the programmed books home or to study halls in order to keep up with the rest of the class.

The possibility of working independently benefits both the slower pupils and the brighter ones. In a traditional classroom situation, a slower pupil will either interrupt the class to receive extra attention and assistance or, because he is embarrassed to admit his difficulty, he will allow the lesson to proceed without his understanding and will fall behind the class. A brighter student may find the learning pace of most of the class too slow, become bored with the subject, and lose interest. Sullivan reading materials, then, in allowing each pupil to work at his own speed, can accommodate both of these types of pupil and give them a better opportunity to learn. To relieve the monotony of such a large amount of individual work, many of the supplementary activities mentioned above provide opportunity for the children to work in small groups.

Teacher Activities

Because of the programmed format, teachers using Sullivan reading materials are given the opportunity to work in the ideal teaching situation,

a one-to-one relationship with the child. Freed from presenting information to groups as a traditional reading program necessitates, the teacher in a Sullivan class functions as a tutor to each individual child whenever that child needs assistance.

Teacher training is recommended as very helpful, but is not absolutely necessary. Teachers' manuals that accompany each set of materials provide complete information on using the materials successfully. The advantage of teacher training seems to be in the area of giving teachers guidance and encouragement in their often new-found role of tutor.

The role of the teacher is of utmost importance in a Sullivan program. Studies conducted by Sullivan at Hollins College in Roanoke, Virginia, showed that pupils had a much greater degree of success with the materials when a teacher provided help and encouragement than when the materials were used without a teacher in attendance. BRL (1971) emphasizes this point in their teacher instructions:

> Regardless of the classroom setting, no single factor will have a more profound influence on the student's success than the effect of encouragement and reward by his teacher. . . . Make it a point to give as much encouragement as you can to every student. . . . Do not take the high level of (your students') performance for granted. . . . The student continues to want and need your encouragement--regardless of how well he is doing. . . . No program can function with optimum effectiveness without drawing on the combined energies and resources that derive from the meaningful partnership of teacher and student [pp. 8-9].

Provisions for Parent/Community Involvement

For most of the materials, no special provisions for parental or community involvement are required or included. However, sufficient and appropriate information regarding the individualized and programmed approach is provided so that local districts can inform parents of the goals and nature of the program.

Parental involvement in Project READ includes a program to train parents as classroom aides, to demonstrate how parents can work with their children at home, and to encourage parents to visit the school to discuss their child's reading progress with the teacher.

Special Physical Facilities or Equipment

No additional equipment other than that supplied by the product is required, nor any special facilities beyond those typically in the classroom.

Recommended Assessment Techniques for Users

Specific behavioral measures of intended achievement are provided in the materials.

ORIGINS

Key Personnel

Although the Sullivan Reading Program development relied on the contributions of hundreds of people, three individuals stand out as the major developers. They are Dr. M. W. Sullivan, Dr. Allen Calvin, and Miss Cynthia D. Buchanan.

Dr. M. W. Sullivan was the developer of the Sullivan Reading Program and is currently a member of the Board of Sullivan Associates and Director of Research for Behavioral Research Laboratories.

Having served in the U.S. Marine Corps from 1943 to 1946, Dr. Sullivan returned to an interrupted college career to earn a B.A. and M.A. in English from Yale University, a B.A. in Spanish from the University of Puerto Rico, an M.A. in Spanish from Middlebury College in Vermont, and a Ph.D. in linguistics from the University of Madrid. His academic experience includes Master of Modern Languages at the Choate School in Wallingford, Connecticut; Instructor in German and English at the University of Puerto Rico; Lecturer in Linguistics at the University of Madrid; Instructor in Spanish at Yale University; and Assistant Professor of Modern Languages at Marquette University in Milwaukee, Wisconsin. In 1954, Dr. Sullivan joined the staff of Hollins College where he held the positions of Associate Professor of Modern Languages, Director of the Language Laboratories, Professor of Modern Languages, Head of the Modern Language Department, Director of Graduate Studies, and Director of Foreign Language Institutes under the National Defense Education Act.

Dr. Allen Calvin is Chairman of the Board and Chief Executive Officer of Behavioral Research Laboratories, as well as Director of Research for

Sullivan Associates. He received his B.A. in psychology from the University of Minnesota, his M.A. in psychology and his Ph.D. in experimental psychology from the University of Texas. Dr. Calvin has been a Research Scientist with the U. S. Air Force and an instructor in psychology at Michigan State University. In 1956, he joined the staff of Hollins College, where he held the positions of Assistant Professor and Acting Chairman. Articles published before the beginning of the Sullivan Reading Program included: "The Growth of Learning During Non-Differential Reinforcement," "Perceptual Differentiation in the Course of Non-Differential Reinforcement," "The Effect of Delay on Simultaneous and Successive Discrimination in Children," "Configurational Learning in Children," "The Relative Efficacy of Various Types of Stimulus-Objects in Discriminative Learning by Children," "The Effect on Non-Differential Reward and Non-Reward on Discriminative Learning in Children," and "Spoken and Written Vocabulary; Their Relation to Standard Vocabulary Test, Intelligence, and Anxiety." Complete references to these articles are provided in Appendix C.

Miss Cynthia D. Buchanan is President of Sullivan Associates, having succeeded Dr. Sullivan in that position in 1970. As a freshman at Hollins College in 1955, Miss Buchanan was Dr. Sullivan's advisee. He recognized her ability and enrolled her in advanced linguistics courses. She received her B.A. in French from Hollins College, and her M.A. in linguistics from Harvard-Radcliffe. She returned to Hollins in 1959 as an assistant instructor in modern languages.

Sources and Evolution of Ideas for Product

The origins of the Sullivan reading materials extended back to World War II, when Dr. Sullivan was serving in the Marine Corps. At the beginning of the war, the United States discovered that they had few people well enough trained in foreign languages to do intelligence work in Europe. Rare was the American who could speak French well enough to convince a German that he was French, and rarer still was the American whose German could fool a German. American intelligence agents dropped behind enemy lines were recognized as American almost immediately because of their lack of foreign language accomplishment. To rectify this embarrassing situation, linguists, a not very common group themselves, were drafted to set up methods of teaching

foreign languages rapidly. The courses they developed initially were repetitive and dull, according to Sullivan, but they eventually evolved to become the Holt-Heath courses in current use.

Through these efforts of the Armed Forces, Sullivan, at that time having done two years of undergraduate study in linguistics in one year's time, became involved in teaching German to Americans. One of his students' tasks was to convince German scientists to come to America rather than go to Russia at the end of the war.

German scientists at that time were technologically more advanced than were Americans. One of the products of German technology was the tape recorder, a device that had not yet been introduced in America. Sullivan recognized the great potential for the tape recorder in the teaching of languages, and he put them to use with his language students. Sullivan asserts that he was the first person to teach using the machine.

At this early point in his career, Sullivan discovered that standard lecturing and drilling techniques were not very effective in the teaching of language, so he switched to a technique utilizing a dialogue between teacher and student in order to discover the student's learning problems and respond to them. He did not, however, yet realize clearly the principles that: (1) learning comes from student response; (2) exact and immediate feedback is necessary for efficient learning; and (3) students need to do well from the beginning or they will become discouraged and lose interest. These are three major principles of learning theory.

Upon returning to civilian life in 1946, Sullivan continued his studies in linguistics at Yale and set up the first "language laboratories" ever developed. He used Webcore wire recorders in laboratories that he built with his own hands, drawing upon his experience with radar in the Marines. The laboratories he set up consisted of a series of listening posts plugged into one machine that played a tape he had recorded. This work continued during his years in Puerto Rico and Madrid (1949 to 1952), but he felt that the language laboratories were a failure since no one seemed to be learning much from them. Upon returning to the United States, having given up hope of making language laboratories work, he discovered that the idea was just gaining in popularity here. Sullivan states that it was not until about 1954 that other language laboratory advocates decided the method was unproductive.

During the years that Sullivan was striving to make language laboratories work, the field of psychology, and more specifically, the area of learning theory, were progressing independently and without much attention from him. A variety of past research paved the way for Sullivan's future work. Behavioristic learning theory came into being in approximately 1913, when John B. Watson pioneered in the field of behaviorism. In the 1920's, S. A. Pressey developed something like a teaching machine while trying to make a testing machine. In the 1930's, psychology really became a predictive science for the first time with the publication of Clark L. Hull's formulas on habit strength. His formulas, based on schedules of reinforcement, could predict specific behaviors. B. F. Skinner, too, proposed a system of behavior, but it varied considerably from conventional stimulus-response psychology. His theories were not well accepted until the 1950's.

Much, then, was known about how people learn and a great deal of research had been done, but until the 1950's, few had applied what is known about learning to the classroom, the place where learning supposedly occurs.

Sullivan relates the following anecdote showing the transition from learning theory in principle to learning theory in practice:

In 1954, B. F. Skinner visited his daughter's elementary classroom, perhaps becoming the first learning theorist to discover the difference between what psychologists believed to be conditions favorable to learning and the conditions of a supposed learning situation. Skinner was reportedly outraged when he saw that the school's most lauded teacher taught in a manner that would make children hate school and would hinder learning more than help it. Confident that he could do a better teaching job, he went home and set up the first "program." His philosophy was to present a stimulus, allow the child to respond, give him immediate feedback to show his response as correct or incorrect, then use what the child had learned to generate another response. Naively, Skinner believed he could simply sit down and write an adequate program.

In Skinner's brush with reality, he had discovered that from a learning theorist's viewpoint, education had remained virtually unchanged in centuries. Still in use was the lecture system, which Sullivan describes as "someone standing up and talking to himself." Sullivan cites a 1960's series of studies that showed that only 20% of an audience is listening to a lecturer at any given moment, and that is under ideal listening conditions. Students

are given no opportunity to respond in the lecture situation and if, as learning theory states, all learning is in the response, certainly very little learning is occurring.

When Allen Calvin joined the staff of the Hollins College Psychology Department in 1955, he was already very widely published and recognized as a leader in psychology. He and Sullivan came to be close friends, and together, they published articles and did studies on the phenomenon of anxiety. Through Calvin, Sullivan learned of B. F. Skinner's work with learning theory and programming.

Sullivan reports that until he became aware of Skinner's work through Calvin, he, Sullivan, had been dissipating his creative energy in the writing of plays, poems, articles, and in acting and directing. He was currently Associate Professor of Modern Languages and Director of the Language Laboratories at Hollins College, but his career had no center, no focus. When he learned of Skinner's work, he was fascinated and very quickly became addicted to "programming." The friendship and professional association between Calvin and Sullivan resulted in substantial contributions to the field of psycholinguistics.

Sullivan had long been an advocate of learning without the intervention of teachers. He thought that materials should teach, not people. With programming as a new source of inspiration and Calvin encouraging him to develop the technique as a teaching tool, Sullivan went back to his earlier language laboratories and did the lessons all over, using the programmed format. It was in the course of developing foreign language programs that Sullivan was motivated to produce programmed reading materials.

Sullivan tested his new programs on local high school students. He found, however, that the students made large numbers of errors in his programs, and the programs were designed to elicit nearly all correct answers. He was sure that his programs were not at fault; the high school students simply could not read well enough to follow the programs. The fact that students at that level could not read adequately infuriated Sullivan, and he was determined to remedy the situation. He began his work in the field of teaching reading.

Sullivan used standard reading programs and set them up in a programmed format using teaching machines (specially adapted tape recorders), but even the brightest children who tried them couldn't learn much. When standard

reading programs, set up according to the principles of learning theory (stimulus-response-reward) to maximize their potential, could not teach children to read, Sullivan concluded that pupils using the reading programs in their normal format were learning virtually nothing from them; all learning was coming from the teacher. Sullivan then set up selected Superman comics in the programmed format and using the teaching machines, and he found that children learned reading much better from the comics than from the standard readers!

Studying the standard reading programs, Sullivan discovered that they made absolutely no use of the principles of linguistics. Linguistics breaks down language into "phonemes," the individual sounds used to form words. After the phonemes have been isolated, a "grapheme" is assigned to each phoneme. A grapheme is the symbol that represents the sound of the phoneme. Linguists, having studied the English language, know which sound-symbol combinations are the most common in our language, and which are the most unusual and, therefore, most difficult. The authors of standard reading programs, however, seemed oblivious to this area of linguistics, and the vocabulary presented was a hodgepodge starting with the wildest and most irregular words in the language. The practice of authors had been simply to accept the vocabulary list set up 150 years ago by McGuffy, "who undoubtedly got it from God," says Sullivan.

The common practice has been to teach common words, even if they were one-of-a-kind in the language. When a child learns "does," he learns that "oe" has the sound of "uh." But when he comes to "shoes," or any other word using "oe," and pronounces it "uh," he will be wrong; teaching such words as "sight" words leads to 100% negative transfer. The child cannot extend his knowledge to master new words. Sullivan describes this method of learning sight words by visual perception as being the same as saying, "I can fly if I simply flap my arms hard enough to take off."

Funding for Product Development

Funds for Sullivan's programming efforts came from a variety of sources. The U. S. Office of Education, General Motors, and U. S. Steel all provided grants to individual people to do independent research. The NDEA Foreign Language Institutes Sullivan directed in the summers of 1959 and 1960 pro-

provided hundreds of thousands of dollars and a fleet of tape recorders and tapes. Sullivan regards a large grant from the Carnegie Foundation in 1959 as the "seed" grant that actually produced the Sullivan Reading Program, although a great deal of research work in programming had been done before that grant was received.

The Carnegie grant, "a substantial sum," to quote Calvin, was originally intended to be used to improve the teaching of foreign languages in the classrooms with programmed materials. Shortly thereafter, however, the grant was expanded to include reading and mathematics programs. A massive later grant from the Encyclopedia Brittanica Films allowed them to build new facilities and to expand programming efforts into the areas of science and geography.

Also in 1959, Hollins College was becoming more interested in Calvin's and Sullivan's work. Pleased to have its two most highly regarded professors doing research that was being acclaimed, Hollins also gave them funds. This grant made it possible to hire Miss Buchanan as an assistant instructor in Sullivan's department. Calvin estimates that a total of $3.5 - 4 million was spent in research and development, perhaps one-third of which went directly toward the reading materials.

PRODUCT DEVELOPMENT

Original Development Plan

Sullivan, Calvin, their associates, and assistants were simultaneously developing so many programs in such a variety of subject areas that it is impossible to isolate the development of the reading materials from the others. Of the thousands of people involved in the development and evaluation of the materials, certainly not all were directly connected with the reading program, but research done in all subject areas was utilized in the development of the reading materials.

Calvin was responsible for setting up the programming patterns and the complicated flow of production. His was also the task of restructuring the school world to accommodate the new materials that would be produced. This latter responsibility was an important one. During the early stages of development, programmed materials were viewed with alarm and suspicion. They were seen as a threat to the existing educational system where the teacher was the focal point of the class and the provider of basic information.

With programmed materials, it was feared the teacher would become obsolete, unneeded when programmed books could provide the basic information. Calvin also contributed suggestions about how people learn, and gave seminars in psychology.

From the very beginning, Calvin realized that hundreds of staff members and a complex routing and rerouting system for programs would be needed. Until 1959, Sullivan and Calvin had difficulty finding someone to direct the complex system. Then, however, they hired Lewis Miller as production manager and he succeeded in keeping the complex procedure operating.

Sullivan was to be the actual programmer of the materials and director of the programming assistants. His role was much more that of a creator and writer than that of an administrator. Sullivan had the dogged perseverence that was required to produce frame after frame of programmed material, only to have it criticized as "trash" and to have himself called "crazy."

Miss Buchanan had a USOE grant to do research in automated teaching of descriptive linguistics. Having just received her master's degree, she says she was "full of the principles of descriptive linguistics" and was very enthusiastic about working on reading programs since no reading materials on the market at that time involved these principles. She was, consequently, to do an independent research project in reading.

One of the major goals of the programmed materials was to keep the child interested in what he was doing. To this end, Calvin's production flow plan included extensive formative evaluation periods. Each program would be tried out by youngsters. Their error rates and comments on each frame of each program would be recorded, and the program would be revised accordingly. Plans called for each program to be tested and retested with additional pupils until no further improvement in error rate or interest level could be made.

Under the Carnegie grant and during previous years of independent research, Sullivan and his programming staff were not looking toward publication. They were interested solely in research and in developing successful teaching techniques. When they started, they were young and idealistic and concerned with doing "something beautiful, wonderful, and good." They had lots of ideas about things they wanted to do in reading, but no time schedule and no definite plan of development. In the last year of the research

project, Sullivan perhaps had some idea of future financial gain, but according to Miss Buchanan, most of the staff was simply enthusiastic about the research for its own sake. What has evolved is a multi-million dollar commercial venture that aims simultaneously to improve children's learning in as many subject areas as they can find time and people to work in and to make money.

In the beginning, they really didn't know what they would wind up with, except programmed materials. Sullivan and his associates still do not know what they will wind up with for the work continues at a hectic pace and Sullivan programmed materials are spreading to all kinds of schools all over the country. Their work began as empirical research, and only later did they envision the variety of products they now produce.

Actual Procedures for Development of Product* and Performance Measures, 1956-1961

Development

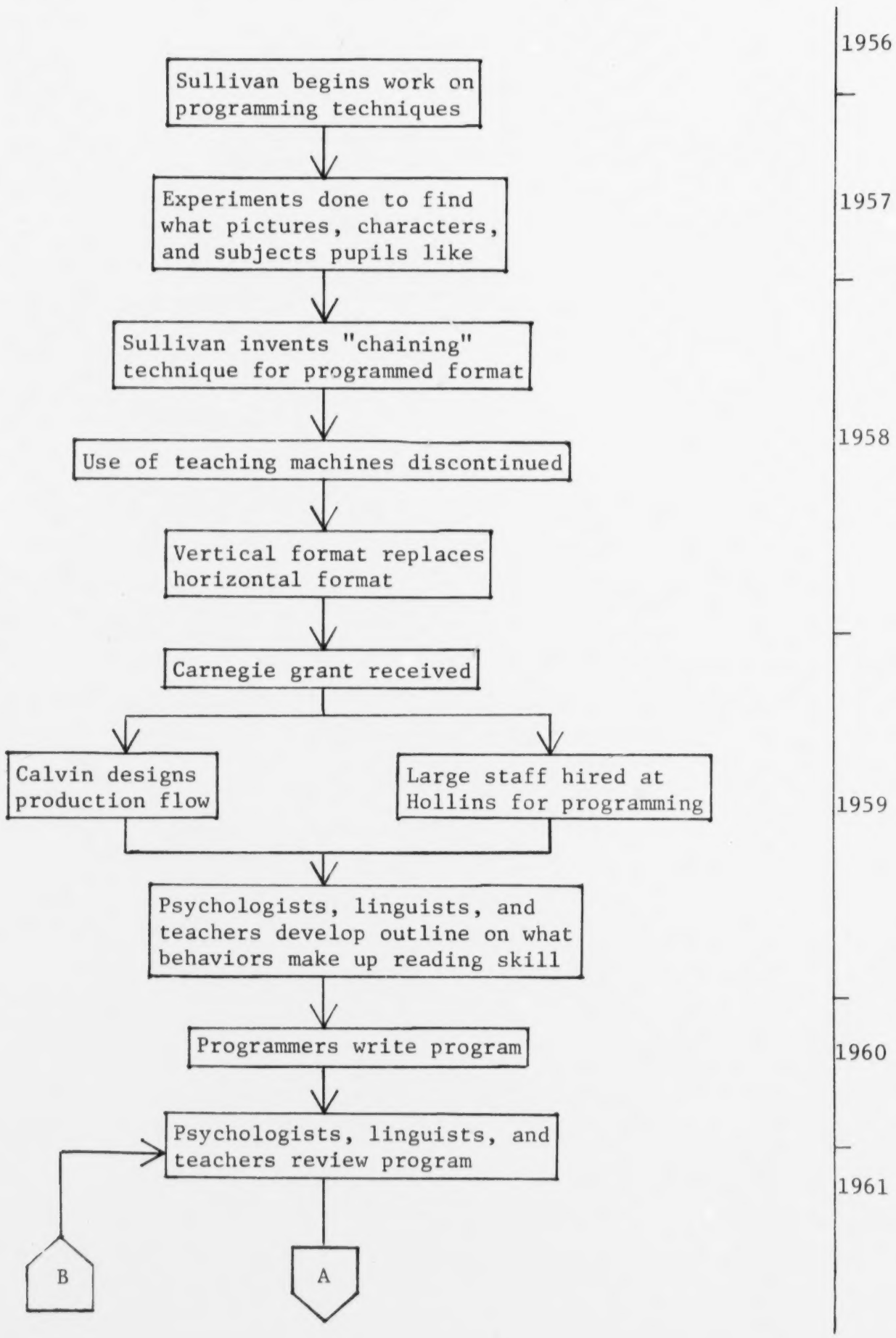
Actual development can be said to have begun in 1956 with Sullivan's first efforts at producing programmed courses in modern languages. Sullivan and his staff generally worked in several areas besides reading, but the research that eventually evolved into reading materials was done and the techniques were refined in all of the subject areas.

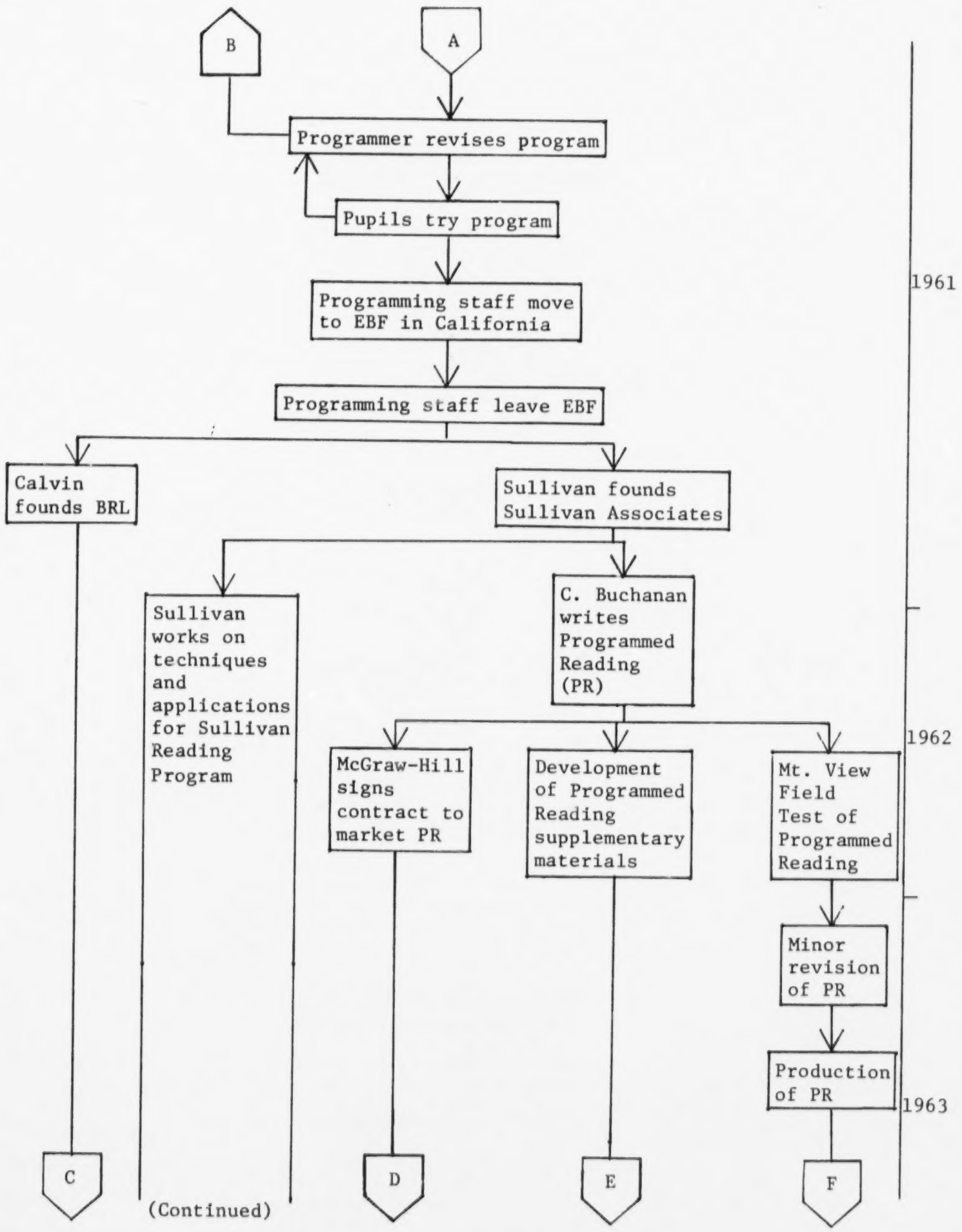
From 1956 until 1959, Sullivan developed his programming techniques mostly in the areas of modern languages. He found that his earliest programs, even in their crudest form, proved to be far more successful than Sullivan himself operating as a regular classroom teacher. Even the best teachers operate under severe handicaps within the standard classroom situation. The only feedback a teacher usually gets, in Sullivan's terms, is "superstitious behavior." The only immediate response to a teacher's lecture comes in the form of smiles, nods, or questions from the class. If a student smiles at a particular point in the lecture, the teacher is reinforced; he remembers that point, perhaps emphasizes it, and uses it again the next year. That point may have been terrible and the smiling student may have been thinking of last night's date, but that lecture point is there to stay, regardless of its merits. Similarly, the teacher's entire teaching strategy is made up of a series of such superstitious behaviors. Sullivan, as a result

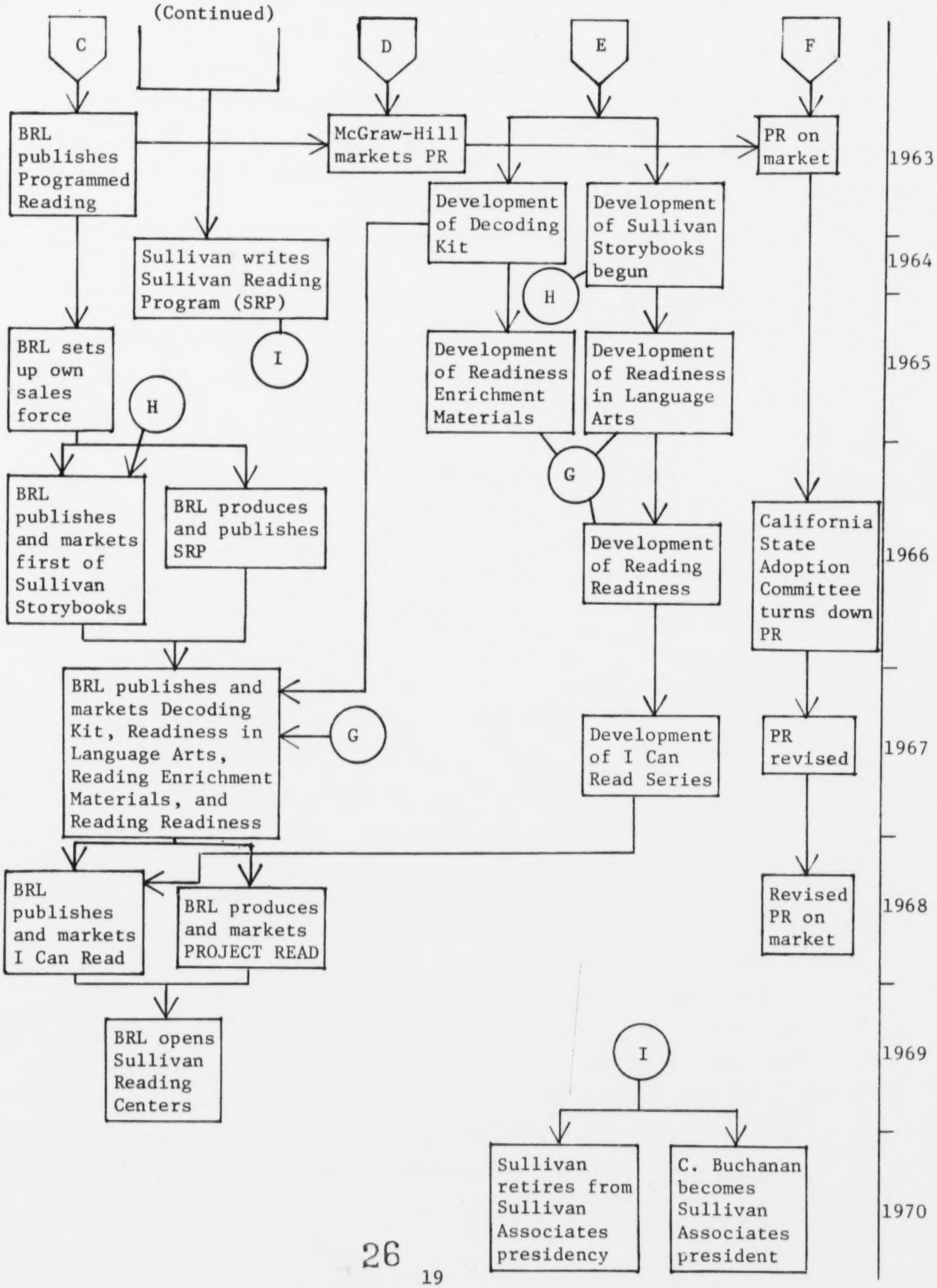
*See Figure 1 for a diagram of the major events in the history of the product.

Figure 1

Major Event Flow Chart


1956
Sullivan begins work on programming techniques
Experiments done to find what pictures, characters, and subjects pupils like
1957
Sullivan invents "chaining" technique for programmed format
1958
Use of teaching machines discontinued
Vertical format replaces horizontal format
Carnegie grant received
Calvin designs production flow
Large staff hired at Hollins for programming
1959
Psychologists, linguists, and teachers develop outline on what behaviors make up reading skill
Programmers write program
1960
Psychologists, linguists, and teachers review program
1961
B
A


B
A
Programmer revises program
Pupils try program
Programming staff move to EBF in California
Programming staff leave EBF
Calvin founds BRL
Sullivan founds Sullivan Associates
Sullivan works on techniques and applications for Sullivan Reading Program
C. Buchanan writes Programmed Reading (PR)
McGraw-Hill signs contract to market PR
Development of Programmed Reading supplementary materials
Mt. View Field Test of Programmed Reading
Minor revision of PR
Production of PR
1961
1962
1963
C
(Continued)
D
E
F


(Continued)
C
D
E
F
BRL publishes Programmed Reading
McGraw-Hill markets PR
PR on market
Development of Decoding Kit
Development of Sullivan Storybooks begun
Sullivan writes Sullivan Reading Program (SRP)
H
I
BRL sets up own sales force
Development of Readiness Enrichment Materials
Development of Readiness in Language Arts
H
G
BRL publishes and markets first of Sullivan Storybooks
BRL produces and publishes SRP
Development of Reading Readiness
California State Adoption Committee turns down PR
BRL publishes and markets Decoding Kit, Readiness in Language Arts, Reading Enrichment Materials, and Reading Readiness
G
Development of I Can Read Series
PR revised
BRL publishes and markets I Can Read
BRL produces and markets PROJECT READ
Revised PR on market
BRL opens Sullivan Reading Centers
I
Sullivan retires from Sullivan Associates presidency
C. Buchanan becomes Sullivan Associates president
1963
1964
1965
1966
1967
1968
1969
1970

of his early tests, knew his programmed lessons could teach better than even the best of the regular classroom teachers.

In the early months of programming, Sullivan and Calvin initiated experiments to determine what types of pictures, characters, and subjects appealed most to children. The results indicated that the pupils liked simple, cartoon-type pictures with direct referents for each noun and operations for each verb. They wanted each picture to be linked closely with a simple sentence so that the reading matter was meaningful to them. This information led to direct revision of the materials.

The years of 1957 and 1958 represented one of the most important phases of programming research. It was then that Sullivan and his associates found the best working format to use. All of the early programs relied on tape recorders. The programs were mimeographed sheets that had been colored in by hand. The sheets snapped into a notebook, and a slider to cover the answer column was used. Each time the child came to a star on the page, he would press a button on the tape recorder and listen to oral instructions. Much of the early materials were tremendously repetitive. The three frames from one of the first experimental mathematics programs below are an example.

6	The set of numbers from 5 to 7 consists of the numbers 5, __, 7.
7	The set of numbers from 5 to 7 consists of the numbers 5, 6, __.
5	The set of numbers from 5 to 7 consists of __, 6, 7.

This format followed the Skinnerian program block, wherein each frame was a totally independent unit. Each frame, therefore, had to include all of the information necessary, even though the previous frame had included it. Results indicated that the children became bored with such repetitive sequences, and one of the major decisions of the staff was to revise the format. In 1958, Sullivan invented "chaining," the building of each frame upon the previous one. Information could be presented just once instead of over and over. A program to teach people how to play chess was the first one

actually to use the new "chained" format, but the reading materials quickly adopted it.

The early stages of programming in 1956 and 1957 made use of an early manufacturer's entire production of teaching machines, and Sullivan's staff produced their own as well. Neil Sullivan, Sullivan's brother, had come to the field of psychology from engineering, and he developed machines especially for the programmed materials. One machine used a film strip with rear projection onto two screens placed in front of the child. A tape cartridge would trigger the filmstrip changes with subsonic impulses.

All of the machines were expensive, so not many purchasers could buy them, and easily broken, so much of the time they were inoperable. Each time the program was revised, a new filmstrip and a new tape had to be produced. Sullivan and his colleagues finally realized that the machines "only enriched the people who made machines," in Sullivan's words, and all of the materials were revised to function without them.

A third major format change involved the organization of frames into programs. The original format divided each page into several horizontal sections.

	1
	2
	3
	4
	5

Instead of reading down the page, the child read line 1 and answered it, then turned the page to find the answer, then read line 1 on the next page. Thus, the child read entirely through the book using only the first row of each page. Then he would start over and proceed similarly with the second row on each page throughout the book. Sullivan felt this format was unsatisfactory. He proposed that the stimulus and response columns be placed on the same page and that the child use a cardboard slider to cover the answer until he had responded to the question. To see if the proposed format would actually be an improvement, Sullivan ran a two-week study of matched groups, one group using each format.

At first, the old format worked better. Sullivan believes that the children liked the opportunity to turn the pages so quickly, and to get through the book so fast. He supposes that they really felt they were accomplishing something. By the end of the two-weeks, however, the children tired of spending so much time turning pages; in psychologists' terms, a reactive inhibition buildup had occurred. Also problematic with the old format was that the time between the child's response and his reinforcement (seeing the correct response on the next page) was too long. The study resulted in the support of Sullivan's new format. Posttests showed that children who had used it had learned better than those who had used the old format.

As Head of the Modern Language Department and Director of Graduate Studies at Hollins, Sullivan put his entire staff to work on programming research. The faculty, graduate students, and even some undergraduates were assigned to do programming research. Calvin's entire psychology department was involved also.

In 1959, with the granting of the Carnegie funds, the programming operation underwent an immense expansion. Scores of personnel from outside the college were enlisted. Carnegie funds allowed Sullivan to hire the best professors in the areas he wished to program. A team of linguists, a team of programmers to assist Sullivan with the actual writing, a group of psychologists, a series of subject matter specialists, and dozens of teachers in local schools were assembled to produce and test programs. Their objectives were quite specific: They were to produce programmed materials for languages, mathematics, and reading and to bring them out of the laboratory and into the classroom.

The first step in the writing of programs was to have the psychologists and linguists set up an outline of what behavior might be involved in learning to read. Then the teachers reviewed the outline to determine if their personal experience with reading problems in the classroom coincided with the ideas of the psychologists and linguists. Teachers were frequently able to add insights into reading behavior from their common experiences.

When the outline had been adapted enough so that everybody agreed on it, Sullivan and his team of assistant programmers would write the first version of the program. The program then went back to the other groups, who would "comment, suggest, and curse," as Sullivan reveals, then be returned to the

programming team. This cycle was repeated at least six times before a child ever saw it. At this point, says Sullivan, the program was still "trash," but at least it was something the child could try out.

Sullivan's initial method of programming was to write or type the programs himself. Giving that up as too laborious, he tried dictating the programs to a superhuman typist. Cognizant of the fact that the typist's time was not being well spent, Sullivan at last accepted Calvin's suggestion that the programs be dictated to a machine, then taken to an assistant to be written up.

From 1959 to 1961, Sullivan and Miss Buchanan were both engaged primarily with research for reading materials. Miss Buchanan was working without salary from the Carnegie grant, although her supplies and office space were covered by it. Her research was toward reading materials to teach beginning pupils to read. She describes this time as "exposure to the field," and as a period of refining programming techniques. Working with children in the reading laboratory at Hollins, she discovered that even before she could think about teaching them reading, she would have to teach them colors, numbers, and directions. Sullivan acted as a reviewer, director, and editor of Miss Buchanan's work there.

Simultaneously, Sullivan was doing preliminary work on a reading program of his own. His materials utilized a different progression of sounds than did Miss Buchanan's, and his work was designed more as a remedial program for children who had tried but failed to learn to read. Miss Buchanan relates that, "He worked like a madman while he was at Hollins," writing, testing and rewriting day and night. "His capacity for work was just incredible." During these years, Sullivan was also writing programs in other areas as well as directing the hundreds of assistants on his staff.

In the early days of programming development, Sullivan and his colleagues who were so dedicated to programming were looked upon as fanatics. Programming seemed to have no commercial significance. After the Carnegie grant pushed programming more into the classroom arena, however, it became probable that programming might be a worthwhile commercial venture after all. Encyclopedia Britannica Films saw the potential in programmed materials and proffered millions of dollars. Using that and the Carnegie money, Sullivan built a new facility at Hollins College in 1960 and employed more than 700 people.

By this time, Sullivan and his programmed learning staff were by far the largest and most important project at Hollins College, which had less than 1000 students of its own. Every year, Sullivan received more grant money for his own projects than the rest of the college had received in its whole history. Sullivan's assistant programmers made more money than full professors outside his group did. Programming proved to be very threatening to the regular professors, as well. It was known that by working with programmed materials at Sullivan's psycholinguistics laboratory, subjects could be learned more easily and more thoroughly than in a professor's class.

Understandably, relations between Hollins College and Sullivan's staff were strained. The Encyclopedia Britannica Films money was given to Sullivan through the dean's office. The dean did not understand Sullivan and his programming madness and interfered with his operation.

Sullivan, Calvin, and Encyclopedia Britannica Films all were ready for a change, and Encyclopedia Britannica offered to build a new center for the programming activities somewhere else. Sullivan and Calvin felt that a new arrangement with EBF away from the college would place fewer restrictions on them, so the programmed learning capital moved from Roanoke, Virginia, to Palo Alto, California.

Calvin selected the new site for several reasons. He was familiar with the San Francisco Bay Area and liked it as a place to live and work. Further, the Industrial Park in Palo Alto was closely associated with Stanford University and provided a particularly good arrangement for organizations to share in the academic community. Consequently, Encyclopedia Britannica Films built a new facility, The Britannica Center for Studies in Learning and Motivation, in the summer of 1961.

There seems to have been little disappointment at Hollins College that Sullivan, Calvin, and their associates were leaving and taking the programmed materials with them. Hollins, a small, exclusive women's college, wished to avoid all the publicity that the programmed materials were attracting. Neither did the college wish to expand to accommodate Sullivan's personal needs.

Calvin was Director of the Palo Alto Center, and Sullivan was Associate Director. Sullivan's faculty from Hollins and some of his students were also transferred. Unfortunately, the new arrangement was less than had been hoped for. Encyclopedia Britannica Films sent their own business managers to run

things, but the business staff and the research staff were unable to work together or understand each other. Sullivan's staff was academically oriented, the corporation was commercially oriented. Having opened in September, 1961, by December Sullivan's staff members had either resigned or been fired, and the Center closed. In hindsight, Sullivan states that it was the "best thing in the world to have happened." The parting of Sullivan and EBF was not, however, quite as agreeable as the separation from Hollins. Sullivan sued EBF for breach of contract. A rather messy legal battle seems to have followed, the details of which are not known. Sullivan seems, however, to have had some degree of success, for his staff received a year's salary.

Formative Evaluation

Thousands and thousands of Roanoke children from the city and county schools were used to test the materials. Children of the Hollins faculty were used the first time through a program. Sullivan describes them as "kids who could get everything right." The first tryout required children who could make enough progress through the program to produce an error rate on each frame and a collection of comments.

After revision by Sullivan and the programming team, the program was tried out on bright kindergarten pupils from the Roanoke public schools. This second tryout would hopefully result in more favorable comments and fewer errors. The third and fourth tryout phases for each program utilized rural children and black children. "They were the most disadvantaged kids anywhere," says Sullivan. Their parents were generally illiterate and their homes were huts without running water.

Each version of the program was different. Frames were added and expanded, and pictures would change. Programs generally grew in length during the revision stages. Children trying out the materials were observed through a one-way glass to see how they proceeded. The early stages also represented a period of deciding what vocabulary the children could master most easily, and what words had the most meaning for them.

The first version of each program generally consisted of what the staff thought and felt. By the time the program had undergone months or years of testing and rewriting, a tremendous amount of pupil input and data had been incorporated. Development of each program represented continuous progress

from its somewhat haphazard beginning to the time when it was accepted as "good." A good program was one that resulted in 19 of 20 frames eliciting correct responses.

Not all of the programs developed turned out to be good. Often, after months or years of work, a program was discarded if it did not come up to Sullivan's standards of acceptability. In this respect, the programmed materials had a great advantage over other textbooks that seldom if ever undergo developmental testing. By the time Sullivan's materials reach the public, they have been proven to be effective by peers of the people who will use them.

Actual Procedures for Development of Product and Performance Measures, 1961-1970

Development

In December, 1961, Calvin and Sullivan set up their own operation in the form of two separate companies. Calvin organized Behavioral Research Laboratories in Menlo Park, California, while Sullivan founded Sullivan Associates in the hills behind Palo Alto. Behavioral Research Laboratories (BRL) was initially funded by $40,000 in private investments. Organized to develop more programmed materials in all areas, BRL also has evolved into the publisher and marketer of nearly all of the Sullivan programmed materials.

The founding of Sullivan Associates by Dr. Sullivan represented a "do or die" situation. Sullivan used about $60,000 of his personal funds to start the company; he was "putting his life on the line, both professionally and monetarily," according to Lewis Miller. Sullivan and Calvin were both so certain that programmed materials worked and would be well accepted by the public that they had few doubts about plunging into the world of business with their products and ideas. Publishers, including McGraw-Hill and McMillan, made monetary advances to Sullivan, too, on the basis of his reputation as B. F. Skinner's brightest protege.

The two corporations are "so interrelated, its terribly incestuous," according to Calvin. Though separate, they are totally interlocking. BRL was set up with Calvin, Sullivan, Miss Buchanan, and John B. Henriksen as the Board of Directors. Calvin, Sullivan, and Henriksen made up the Board of Sullivan Associates, as well. Sullivan Associates has been almost entirely

responsible for the actual development of the reading materials, however, so BRL will receive little further consideration in this report.

Approximately 20 people made up Sullivan Associates' permanent staff in the beginning. Sullivan was President, Lewis Miller was Executive Vice President, and Cynthia D. Buchanan was Secretary-Treasurer. The nucleus of Sullivan's programming team at Hollins made up part of the staff. The remaining staff members were all recruited from among Stanford University students and graduates. Some held Ph.D.'s; many secretaries had earned master's degrees.

Staff relationships under Dr. Sullivan are relevant to the development and success of the programmed materials. He does not seem to have been an easy man to work for. Brilliant and completely devoted to his work, Sullivan had high expectations for the quality and quantity of work produced by his staff. Reportedly impatient with people who could not think and snobbish about academic degrees of his own and of his staff, Sullivan demanded perfection from them. He speaks with disgust of professors who came both to Hollins and to Sullivan Associates unwilling or unable to invest the time and energy required to write programs. He had no trouble finding people to hire; working for him was an honor and a challenge, and if an assistant did well, he would find Sullivan charming and exciting to work with. If, however, an assistant did not do well, there could be no working relationship and the assistant would have to leave. Little personnel turnover occurred during projects, according to Lewis Miller. Staff members came and went, but mostly between projects and because of their own interests.

Each project at Sullivan Associates had its own staff, but all staff members contributed to and criticized each other's work in regular "critique sessions." Subject matter specialists, hired as subcontractors for specific projects, had their own specific areas of responsibility, but no one worked exclusively on one thing. Since its founding, approximately 90% of the work at Sullivan Associates has been toward development and refinement of reading materials.

With the founding of Sullivan Associates, M. W. Sullivan removed himself from the cloistered life of an academic researcher and entered the world of business. Sullivan and Calvin and their assistants came to the realization that they were experts in the field of learning, and decided it was time to advance programming from the research and laboratory stage and put it into

operation in classrooms. Many men would have had great difficulty in making the adjustment from being a professor and researcher to becoming an administrator, but Sullivan met the problems with aplomb. He examined each new task carefully, dissected it, then studied the subject at hand systematically until he had mastered it. Lewis Miller offers as an example of Sullivan's ability to cope with the business world the story of Sullivan's meeting with a publisher. At their first meeting, Sullivan was inexperienced in the field of publishing. He listened carefully to all that was said but said little himself. Before the next meeting with the publishers, Sullivan read and studied about publishing. At the second meeting, he knew more about the field than did the publishers and asked questions they could not answer. Then he took the contract they had offered, rewrote it to suit himself, and had them accept it.

The function of Sullivan Associates was, like that of BRL, to develop programmed materials in all fields. In 1961, much of their course had been predetermined by the research that had taken place at Hollins. Sullivan and Miss Buchanan had both completed most of the research necessary for the two different reading programs. They had brought with them the research notes and pupil booklets they had developed at Hollins. Their programs had been worked on for years and had been tested and retested. All that remained to be done was to find the most attractive way to present the programs and to do a polished rewrite of the programs that they knew worked. At Sullivan Associates, Miss Buchanan wrote from her two years of Hollins research the complete series of 24 books that comprised the basic part of the first Programmed Reading series. As he had in the past, Sullivan acted as editor and critic of this field test edition.

As the writer, Miss Buchanan oversaw production activities for her materials too. Early production procedures were informal; she directed and "galley slaves" did the illustrating and pasting up. Having the production phase so closely related to the development phase was a mixed blessing, according to Miss Buchanan. She did not know much about production, so mistakes and problems were inevitable. On the other hand, the developers of the materials were able to develop all their own formats and designs so that the form and content would mesh by using such a production system.

While Programmed Reading was undergoing its final writing and field testing in 1961-1963, as described below, Sullivan did only occasional work

on his own reading program. He did, however, work on techniques and applications of the materials for remedial pupils. Using some of the pupils at the Programmed Reading field test schools who had reading difficulties and were reading far below their grade levels, Sullivan tested various page formats using folders of loose-leaf materials. During these trials, Sullivan decided on a new "box" format that was later used in many other programmed materials.

When he was satisfied that he had found the best format and that remedial reading pupils actually found success and enjoyment with his materials, he wrote the final version of the Sullivan Reading Program and delivered the draft to Behavioral Research Laboratories for production. Calvin assembled some thirty artists to prepare the program for publication. The actual publication and distribution of the two reading programs will be covered in the Diffusion and Adoption sections, below.

Decisions about what supplementary materials to develop were generally up to Sullivan. He did not use performance measures to determine if the children needed a certain type of enrichment or supplementary material. Neither did he ask "knowledgeable" people if they thought the materials were needed. He trusted his own intelligence, experience, and intuition. As Miss Buchanan points out, however, Sullivan is a rather extraordinary man. When you are the expert, you do not need to ask the opinion of people who do not know nearly as much about your subject as you do.

As they began to supplement the basic reading programs, Sullivan carried both the administrative and creative responsibilities of Sullivan Associates. Miss Buchanan carried much of the creative burden, too; however, Sullivan would give the original directions and ask Miss Buchanan to develop a plan for the project. Together, they refined the plan. She was then responsible for executing it, either as sole author or as principal author with some assistance. Sullivan then would give final approval and the product would be field tested. Each part of the materials is generally the result of one person's work, with lots of help from others.

Prepared in this manner were the following programs: Sullivan Storybooks (to accompany Programmed Reading) whose publication began in 1965 and continued until 1971; Sullivan Decoding Kit; Readiness in Language Arts Program, the Enrichment Materials, and Reading Readiness, all of which were published in 1967; the I Can Read series, published in 1968; and the Comprehension Readers, published in 1970. Several of these projects were always in progress.

In 1966, Sullivan Associates submitted Programmed Reading (distributed by McGraw-Hill) to the California State Adoption Committee. The program was not accepted for adoption, so Sullivan Associates spent 18 months revising the program. Other considerations were also involved in the decision to rewrite the materials. The Cleveland schools had expressed a desire for a better racial balance within the series. Sullivan Associates had learned, also, since the first publication, that learning was improved directly as the number of pupil responses were increased. Consequently, Programmed Reading, the only basic reading series to be revised before it had been on the market five years, was revised, starting in 1966. Black, brown, and oriental characters were added to the series and 40% more responses were added. Diagnosed tests were interspersed at regular intervals to aid teachers in grading and diagnosing individual progress. The prereading materials were also revised, to accommodate the trend toward teaching reading in kindergarten, and the prereading program was simplified and streamlined to introduce pupils to words and simple sentences earlier. Further, three years of use had demonstrated that the teachers needed more detailed instructions, so the teacher's guides were rewritten.

From the mid-1950's until 1970, M. W. Sullivan had devoted virtually all of his energies and creativity to researching and writing programmed materials. At Sullivan Associates, he had carried all administrative responsibilities, as well as most creative functions. By the end of the 1960's, Sullivan was tired and realized that he had done nothing but work for 15 years. Yet he did not feel that programmed learning could continue to thrive and improve without his constant attention. For months, Sullivan was tortured with the decision of whether he should continue devoting his life to his work or whether he should remove himself from the forefront of programming activity and consequently allow programming to die.

Even though Miss Buchanan had worked with programming nearly as long as he had and had even been personally responsible for the creation of many of the reading materials, Sullivan did not see her as a potential administrator. Finally, however, he became convinced that his long-time assistant was capable of assuming both creative and administrative functions of Sullivan Associates. Exactly how Sullivan's decision was made is not clear. He reports that Miss Buchanan had been telling him for 15 years that she could run things better than he could, so he finally decided to let her. Miss Buchanan, on the other

hand, states that Sullivan talked her into assuming the new role. In either case, in June, 1970, Sullivan stepped down and Miss Buchanan became President of Sullivan Associates.

Miss Buchanan and Dr. Sullivan had done all of the actual writing at Sullivan Associates. With his departure, Miss Buchanan hired five girls to take over some of the writing duties. They were Stanford graduates with degrees in English. Miss Buchanan directed their work, but allowed them to work out their own techniques. As members of the Board, Sullivan and Calvin give suggestions, but Miss Buchanan makes the decisions under their advisement.

Although 90% of Sullivan Associates' work has been with reading, they have recently branched out into mathematics, science, and social studies programs as well. Miss Buchanan currently employes a permanent staff of 18 with about 25 free-lance writers and artists fairly constantly employed. She has given up writing herself, and now she turns that responsibility over to project directors. Miss Buchanan gives directions, the project directors develop plans, then together they refine them. The project director is then responsible for executing the development plans with the help of permanent and free-lance staff. Miss Buchanan gives personal final approval to every aspect of every program.

When asked about the major problems the programming staff has encountered since the founding of Sullivan Associates in 1961, Miss Buchanan, without hesitation, replied, "writer's cramp." She does include two other areas as sources of major difficulty. The first is the area of personnel. Sullivan and Miss Buchanan have found it very difficult to find good people for the staff. Writing the programmed materials requires brilliant people who excel in their subject area and write well, too. The task also requires hard work and imagination. Sullivan and Miss Buchanan trusted only themselves to write programmed materials for many years. Since Sullivan's semi-retirement, Miss Buchanan has found "a couple" of people whom she "nursemaided" into becoming good programmers.

The second problem area has been production. With their own orientation toward writing, both leaders of Sullivan Associates have had difficulty realizing the importance of production and devoting enough time in each product's development schedule to it. Miss Buchanan now recognizes the importance of keeping the creative and production phases of product development

separate. Clashes between the creative staff and production staff are common, but Miss Buchanan is attempting to keep both in balance at Sullivan Associates. She currently has her managing editor in charge of production to insure that the two phases of development operate harmoniously.

Formative Evaluation

The Programmed Reading series was tested in Mountain View, California, in a temporary, dittoed form. Arrangements were made by contacting the teachers of Lewis Miller's children. From 1961 to 1963, the materials were used by three regular classes and one remedial class. Mr. Miller lived across the street from the Mountain View school, and each morning he would take packs of dittoed programs in his child's red wagon across to the pupils. No teacher's guide had yet been prepared, so Miller would give oral or handwritten instructions to the teachers for that day's lessons. Two tons of ditto paper were used during the two years of field testing.

Miss Buchanan and her assistants knew that her materials were effective because of the years of developmental testing at Hollins. Sullivan, however, insisted that each program have no greater than a 5% error rate, and he demanded that the newly prepared materials be tested in the classroom to insure that that rate was not exceeded.

The experimental groups using Programmed Reading were a first grade class of nine girls and 13 boys, a second grade class of six girls and seven boys, and a remedial class of second- and third-graders having five girls and six boys. The control group was equated with the experimental group as far as was possible on the basis of age, sex, IQ, and socio-economic background. All of the pupils were from "average," middle-class communities. Both groups were tested at the beginning of the school year with the appropriate Lee-Clark or Gates test, and were retested both in January and June. Administered by the regular classroom teachers and in cooperation with the school principals, the tests were given under uniform and standard procedures.

Results of the first year of testing showed that the error rate on the programmed text was less than three percent and on the accompanying tests was less than five per cent. In average total reading grade growth, the experimental first grade class gained 2.0 years while the control class gained 0.9 years. The experimental second grade class gained 1.4 years,

while the control group gained 0.9 years. The remedial class using Programmed Reading gained 2.3 years in average total reading grade growth. A more detailed analysis of the results is included in Appendix A.

While the basic books of Programmed Reading were being field tested, the supplementary materials for the series were undergoing development. The teacher's manuals, Decoding Kit, Placement Examinations, and Pre-Reading materials all were prepared during this period.

Upon conclusion of the field test of Programmed Reading in 1963, teachers' and pupils' comments were considered and the materials underwent a final minor revision. Final production of the materials was completed by Sullivan Associates, including the typing and art work.

Aside from the programmed texts of the two basic series, the Sullivan materials did not undergo extensive developmental testing. Such trial runs had been possible before because of the Carnegie grant, but at Sullivan Associates, the sums of money necessary for extensive developmental testing were not available. Neither did the staff feel that developmental testing was necessary to insure the quality of the supplementary products. The Sullivan programming techniques had been thoroughly refined at Hollins; they were known to be effective. The only new element to be introduced by any individual product was the specific content, and since that content was under the strict supervision of Sullivan, they had little fear that the supplementary materials would be unsuccessful. Any minor problems about stories or characters the children did not like were found during the field tests.

All of the materials were field tested, but to varying degrees. Field test contacts were generally made through personal contacts. After a few teachers had used Sullivan materials, their reputation spread, and teachers requested the opportunity to try out the materials. Schools in the San Francisco area were the predominant field test sites.

Field tests were generally rather informal; staff members would deliver the materials to be tested and offer general instruction, then leave the materials with the teacher. The teacher would observe the pupils as they used the materials. A staff member would then return to the class, record the teacher's observations and comments, and ask the children for their response to the materials. Pupil and teacher responses, as well as error rates recorded where possible, were then used to revise the materials for the published version.

SUMMATIVE EVALUATION

Such a large number of field tests have been carried out by independent school districts and researchers that discussing all or even collecting their results is beyond the scope of this report. Many of these field tests have been conducted completely independent from Sullivan Associates.

A few representative field tests are described below. The total number of field tests with positive and negative outcomes is not known; but since orders for Sullivan reading materials continue to increase, and since large orders are being renewed rather than cancelled, it may be assumed that results of using the materials are favorable more often than they are unfavorable.

Colorado Springs School District 11

The school district in Colorado Springs, Colorado, used the Programmed Reading materials during 1965-66. Mr. Lew Miller, then a consultant for McGraw-Hill, and Mr. Lyre Patterson, a McGraw-Hill sales representative initiated the field test with Dr. William Liddle of the district. It was decided that one first grade class in each of four schools would use the Programmed Reading materials exclusively. A control group in each school was set up to use the McKee basal reading series from Houghton Mifflin. The four schools represented areas of high socioeconomic, an upper-middle, low-middle, and low socioeconomic status. The children's IQ's ranged from very low to very high. Miller acted as a consultant in getting the teachers started. Sullivan and several other people also assisted as consultants.

The experimental group was considerably disadvantaged because of a large turnover rate in the schools. All new first grade pupils entering the district during the year were placed in Programmed Reading classes. Pupils in the experimental group numbered 114; in the control group, there were 113 pupils. Sixty-two girls and 52 boys made up the experimental group. The control group had a similar composition. Instruction was given for 180 days, and the teachers had 4, 9, 13, and 14 years of experience, respectively.

The experimental and control groups were very similar in levels of reading readiness and in IQ at the beginning of the year. At the end of the year, the Metropolitan Achievement Primary I Battery was administered to both groups. Combining the four experimental classes and the four control classes, statistically significant differences were found in Word

Knowledge ($p<.02$), Word Discrimination ($p<.01$) and Total Reading ($p<.01$), all in favor of the experimental group. Great enthusiasm was shown by teachers, parents, and children alike toward the materials.

San Francisco Unified School District

During the 1968-69 school year, the San Francisco Unified School District measured the performance of 1,276 Project READ pupils. Twenty-seven schools participated, all but six of which were located in poverty areas. Pupils were pretested in May, 1968, and posttested in May, 1969, with the Stanford Reading Test. Each child used the materials two or three times a week throughout the year.

Dr. Robert Jenkins, then Superintendent of the San Francisco Unified School District (September, 1969) commented on the results of the pre- and posttesting:

> The Stanford Achievement Test is not an instructional test reflecting local goals, but rather it is a status test, culture-bound, relying on experiences children have had. Correct responses are empirical: they reveal what experiences children have undergone and what has happened in the past under conditions of the past. In the interpretation of such test data, it is important to focus upon the upper quarter of these pupils who tested at or very close to grade level on the standardized test.
>
> These children have more successfully realized their abilities and capitalized upon previous experiences to the point where, by test standards, they are performing satisfactorily. This quarter of the San Francisco pupil population is nonetheless urban in background; the reader is reminded, as explained in prior test reports, that the test norming process did not include many large city pupils [p. 6].

Summarizing the results of the project, Jenkins reported (1969) that ten of the schools showed one year or more of reading growth, and the other ten showed eight or nine months of reading improvement. Further, 43% of all pupils in the district in grades H3 through H6 made month-per-month gains. Sixty-three percent, however, of a comparable group of Project READ students made the same month-per-month gains. These results compare most favorably to earlier testing before Project READ installation that showed month-per-month loss of reading skill (pupils were falling further behind actual grade placement levels).

The Metropolitan Readiness Test was administered to all San Francisco public school pupils at the end of kindergarten or the beginning of grade one. Using this test, the readiness status of a pupil can be compared to the national norms in which the average pupil would be ranked at the 50th percentile, the highest scoring quarter of pupils at or above the 75th percentile, and the lowest quarter at or below the 25th percentile.

In 1966-67, Project READ had not yet been installed in the schools. In March, April, and May of 1968, Project READ had an eight-week trial run in 31 schools. During 1968-69, Project READ had a full year of operation.

Results of the three years of testing with the MRT showed the following:

1. Readiness status of all pupils in Project READ increased markedly during the two years of the program at the kindergarten level. For all 31 project schools, the 25th percentile status children increased by 11 points on the national percentile scale, the 50th percentile by 15 points, and the 75th percentile by 14 points.

2. The improvement in eight bilingual schools (those schools having a majority of their pupils with Chinese or Spanish as a native tongue) was about 50% greater than in the unilingual schools: 23 to 15 points of increase at the 75th percentile, 21 to 13 points at the 50th percentile, and 13 to 8 points at the 25th percentile.

3. In the disadvantaged schools (25 of the 31), improvement seemed to have been greatest for the 75th percentile and least for the 25th percentile children. A reversal of this finding was observed for the six advantaged schools.

Complete data are provided in Appendix B.

Vicksburg Summer Reading Program

During the summer of 1968, the Vicksburg, Mississippi, Municipal Separate School District offered an intensive remedial reading program, using the Programmed Reading materials. The program was funded by Title I, ESEA. Two full time consultants from BRL assisted in implementing the program, which was to run four hours a day for seven weeks. A pre-service workshop totaling about six hours of instruction was conducted by the BRL consultants. The staff was introduced to the materials, instructed in

placement of pupils at the proper reading level, and in methods of presenting the materials to the students.

All pupils in grades 1 through 6 with below grade level reading ability were invited to attend. Of the slightly more than 700 pupils registered, 83% were black and 17% white. Approximately 50% of the pupils were from low-income homes. Each class, consisting of about 26 pupils, was led by a team of one white and one black teacher. Students were placed with others of their general ability after taking the Gates-MacGinitie Reading Test for vocabulary and comprehension levels. This test was given the first day of class.

Pupils spent approximately 3¼ hours each day using the programmed texts, interspersed with periods for supervised activities, free reading, listening to taped stories, and refreshments. Teachers attended two-hour workshop sessions with the consultants each afternoon to review the morning's activities, prepare instructional materials, and review methods of presentation. Teaching techniques and examples were illustrated on video tape.

Of the 60% of the pupils who were both pre- and posttested with the Gates-MacGinitie Reading Test, 59% showed measurable achievement in vocabulary and 54% showed positive achievement in comprehension. Table 1 shows the percentage of students at each level of achievement (Fairley, 1968).

Table 1

Results of Vicksburg Summer Reading Program
Using Programmed Reading Materials

Achievement In Years	Vocabulary Percentage	Comprehension Percentage
+ .1	9.5%	7.3%
+ .2	8.8%	7.5%
+ .3	6.3%	7.8%
+ .4	3.7%	3.2%
+ .5	3.9%	5.8%
+ .6	5.3%	3.6%
+ .7	3.9%	1.5%
+ .8	5.4%	3.4%
+ .9	2.2%	2.7%
+ 1.0 & over	10.0%	10.1%

The school district reports that there was evidence of high interest by the students in the program. Teachers often related incidents of pupils wanting to continue work in the programmed texts rather than take part in play activities.

Belcher, Louisiana

During the 1969-70 school year, 1,290 children in grades K through 12 in Belcher, Louisiana, participated in Project READ. Not all students and teachers participated the entire time because of transfers. Stanford Achievement Tests and California Achievement Tests were given as pre- and posttests. The Lee-Clark Reading Readiness Test and Sullivan Reading Placement Tests were also used. A total of 69 teachers were trained by BRL consultants, and in-service consultations were also utilized.

The development and growth of language arts skills was evaluated by the tests already mentioned, as well as by observance of pupil work habits, of expressions of increased academic security, and of the extent of pupils' command of skills. Participating teachers commented that pupils' attitudes toward learning had improved and positive self-concepts had been developed and/or strengthened, they became more independent in their work habits, potential dropouts increased their attendance, and pupils who had been previously withdrawn now participated voluntarily.

Data collected for the October 28 to February 17 semester is shown in Table 2 (Rollins, 1970). Average gain in grade placement was 6 months, compared to a 3.2 month expected gain. Figures in the table represent mean grade placements.

Kern County Joint Union High School District

This district in Bakersfield, California, used Sullivan programmed reading materials during 1966 and 1967 with 50 severely disadvantaged ninth grade students whose reading abilities ranged from the fifth grade level to the non-reading level. Since considerable evidence has already been indicated resulting from other field tests using a much greater number of students, the data concerning cognitive gain will not be considered here. However, Dr. Dave Martin of the University of Southern California studied the affective results of the programmed materials.

Table 2

Results of Belcher, Louisiana, Evaluation of Project READ

(P <.01)

Grade	No. Tested	LEE-CLARK READING READINESS	STANFORD ACHIEVEMENT TEST		CALIFORNIA ACHIEVEMENT TEST	
			Pre-Test	Post-Test	Pre-Test	Post-Test
K						
1	76	0.7		1.5		
2	85		1.4	1.7		
3	86		1.5	2.2		
4	83				3.0	3.7
5	93		2.9	3.9		
6	96				4.3	4.7
7	104		4.1	4.3		
8	101				5.6	5.8
9	121		4.9	6.1		
10	110				7.5	8.1
11	100		5.2	6.1		
12	100				8.1	8.4

Forty-five of the students in the program were interviewed by Dr. Martin in April, 1967. The interview consisted of ten open-ended items. Interviews were taped and the tapes were coded and analyzed.

The first question was designed to elicit expressions of general affect. Fifty-six per cent of all pupils responded with "Unqualified Liking" of the program, 42% with "Qualified Liking," and 2% (1 pupil) with "Dislike."

The second question was designed to find the extent to which pupils thought the class helped them. Eighty-seven per cent responded with "Helped Greatly," 9% with "Helped Somewhat," and 4% with "Doubtful or None."

The third question was, "What are some of the things you enjoy doing most in this class?" Responses are listed below:

Sullivan Workbook	48%
Sullivan Reader	9%
Games	18%
Plays	4%
Discussion	7%
Tapes	2%
Everything	2%
Nothing	10%

Another question was, "How do you think the other students like the class?" Responses were summarized: "General Liking" received a 56% response; "Ambiguous or Don't Know" received a 33% response; and "General Dislike" received a 9% response.

DIFFUSION

Diffusion of the Sullivan reading materials is generally the responsibility of Behavioral Research Laboratories under Allen Calvin. BRL owns all of the Sullivan programmed materials and publishes them. McGraw-Hill Book Company does market the Programmed Reading series, however.

In 1962, while Programmed Reading was undergoing field tests in Mountain View, California, Mr. Ken Ziegler of McGraw-Hill evinced interest in doing the marketing of that series. Sullivan, who then held the copyright, signed a contract to that effect with the Webster Division of McGraw-Hill, with Sullivan and the company each receiving half the profits.

Later, Sullivan traded his copyright and his share to BRL in return for shares of stock. McGraw-Hill began marketing Programmed Reading in 1963 but, according to Lew Miller, their efforts were not very successful. Only about $187,000 was received the first year. Mr. Miller left Sullivan Associates and joined McGraw-Hill the following year to instigate better marketing procedures. By 1970, $10,000,000 in Programmed Reading (revised edition) had been sold.

In 1965, BRL founded its own sales force to handle marketing of the rest of the programmed materials developed by their own group and by Sullivan Associates as well. In 1966, the Sullivan Reading Program that Sullivan had personally authored was published by BRL, who also had handled the production phase.

During the early days of dissemination of the programmed materials, McGraw-Hill and BRL had to contact school districts to try to sell the programs. Use of the Sullivan materials has had such a great impact and has received so much publicity, however, that by the late 1960's, most sales were user initiated.

In 1968, BRL developed the teacher-training and consultation services to accompany Sullivan Associates' reading materials and began marketing Project READ, which now accounts for the great majority of reading program sales. If a school district can place an order for $40,000 or more for BRL/Sullivan reading materials, the district is eligible for Project READ, which is currently in use in at least 100 large urban school districts. Calvin estimates that the relationship of materials sold under Project READ to materials sold individually as 5 to 2. He also estimates that under Project READ, the cost per student is less ($.20) than without the added project services. Small school districts, unfortunately, have difficulty meeting the $40,000 minimum order limit.

Project LEARN is a newer system offered by BRL that uses Sullivan materials. This project includes BRL assumption of school management responsibility. In return, they guarantee a certain level of student academic improvement. If students do not show promised improvement, the school district does not have to pay the full cost.

The newest diffusion technique utilized by BRL to disseminate Sullivan reading materials is the opening of Sullivan Reading Centers in cities across the country. According to 27 different criteria, BRL selects a

possible site for a reading center, then works with the approval of a local school district to set it up. The 27 criteria are trade secrets according to Calvin. Directors of the centers are carefully selected; to this point, they have all been teachers who have received special training. Paraprofessionals, generally graduate students or teacher trainees, also staff the centers.

Sullivan Reading Centers are open to anyone who wishes to improve his reading skills. Newspaper, magazine, and billboard advertisements, and teacher referrals are used to make poor readers and parents of poor readers aware of the service. Each potential customer is given a battery of diagnostic reading tests to determine the nature of his reading problem. Most pupils go to the center after school, but special arrangements can be made for a child to go to the reading center instead of his regular reading class during school hours. Sessions last at least four weeks to give each child a chance to realize noticeable improvement. Pupils may attend from two to five times each week for one hour each day. For the fee of $5 per hour, the pupil has his reading problems diagnosed, books assigned that he may keep, and professional and paraprofessional tutoring whenever he requires it.

ADOPTION

Extent of Product Use

Allen Calvin estimates that approximately 5 million people are using Sullivan programmed reading materials. At least 100 large urban school districts use Project READ. There are 17 Sullivan Reading Centers, with many more planned for the future.

Calvin describes programmed materials as the fastest growing, most widely accepted method of innovative teaching. So many schools use the reading materials, that Calvin feels it is impossible to characterize the majority of users; all kinds of schools use them. Generally, the Sullivan Reading Program is used more by inner-city schools while the Programmed Reading distributed by McGraw-Hill is used more by schools with pupils less likely to have serious reading problems. Since sales are growing tremendously the big project orders are renewed and new cities are placing orders, Calvin assumes that users are pleased with the materials.

Installation Procedures

If a school simply orders the materials, teachers rely on the teacher's manuals for information on implementation of the program. The only adaptation of a standard classroom situation that might be necessary is rearrangement of the furniture to accommodate the different simultaneous activities of pupils working individually.

Since the role of the teacher in a Sullivan classroom is probably a new one for most teachers, teacher training is most helpful and is provided when the materials are purchased in a project. When no teacher training or consultation is provided, teachers must rely on the teacher's manuals, but these instruments are carefully designed to give the teacher as much information and advice as might be needed. Teacher training provided with Project READ includes presentation of films, role-playing, and workshops. The evaluation of these teacher training procedures also falls within Calvin's broad category of "trade secrets."

Extra staff within a classroom using Sullivan reading materials is not required, but any paraprofessionals in the classroom can be helpful to give pupils with individual problems more thorough assistance.

Because of the wide variety of reading materials available as part of the Sullivan program, considerable product modification is possible. Any combination of the materials is purchasable. Optimal success is, however, linked with the properly sequential use of the major materials.

In the early days of programmed materials, considerable public relations work had to be done before the materials could be sold. Teachers were very skeptical and suspicious of the new teaching method; they feared that their own role would be diminished if programmed texts could teach so well. After years of publicity and good results, however, programmed materials are no longer seen as threatening and they are easily acceptable to teachers and administrators as a more effective substitute for standard reading programs.

Success of Installation Procedures

Sullivan reading materials seem to be easily installed in nearly every type of school. If teachers follow the suggestions given by BRL and discussed in the Description of Materials section of this report, installation should not be problematic. Publicity in magazines and newspapers, ranging

from the Newark Evening News to the Congressional Record, overwhelmingly records the enthusiastic response of teachers, parents, and pupils who have had experience with the Sullivan materials.

COSTS

Because early development of the reading research is so intertwined with the research for other subjects, it is impossible to determine the costs of developing the reading materials. The developers themselves do not really know what has been spent; their early concern was academic and not financial. Three and one-half to four million dollars was spent in research and development at Hollins. Perhaps one-third to one-half of that was for reading. But millions of dollars have been spent on every phase of development. When Sullivan and Calvin founded Sullivan Associates and Behavioral Research Laboratories, they started a multi-million dollar educational empire. BRL lists total sales for 1970 as more than $10 million, but that, of course, includes many other materials besides reading programs.

FUTURE OF THE PRODUCT

When Sullivan realized the effectiveness of programmed materials, he and his colleagues believed that within decades, education would be converted almost entirely to programmed learning. Their enthusiasm and expectations have cooled somewhat, but sales are steadily increasing and more and more subjects are being programmed. The reading programs are being continually supplemented, and will undergo revision as it becomes necessary.

When programming was new, voices from many places were raised to say they were going to do programming, too. Some "programs" were published that are not really programs, as far as Sullivan is concerned. They are simple repetitions of materials, formated in boxes, with blanks and questions inserted. The learning theory principles of stimulus and response are missing. If another group were to begin writing "real" programmed materials, they would have to begin where Sullivan began in the 1950's. He feels that no one else would probably have the required intelligence or drive to be as successful as his group has been.

Sullivan Associates and Behavioral Research Laboratories do not intend to divulge their myriad trade secrets either. They have worked very hard for

a long time and they now have every intention of reaping the generous rewards of the programming business. Sullivan programmed materials published by BRL currently account for about 95% of the programmed materials on the market.

CRITICAL DECISIONS

Sullivan emphasizes that it is virtually impossible to enumerate the critical decisions that were made during the decade and a half covered by this report. Thousands of decisions were made, some critical, but most rather insignificant. They did all combine, however, to mold the products of the Sullivan programmed materials into the form in which they exist today. Listed below are a few of the decisions that seem, in hindsight, to have been major factors in the development of Sullivan reading materials.

Decision 1: To Work with Programmed Lessons

Perhaps the most momentous decision involved in the development of the Sullivan reading materials was Sullivan's initial decision to work with programmed materials. That the linguist would work with programming seems to have been predetermined rather than decided. His career had lacked a focus and suddenly, upon learning of Skinner's early attempts, he knew that he would program.

The development of the reading materials was not a case of wanting to improve reading instruction and then seeking the means to do so. It was instead a case of discovering a valuable teaching tool and seeking a deserving subject to teach with it. Had Sullivan (and others) not taken up the programming aegis in 1956, the teaching of reading might be plodding along in the tradition of centuries.

Decision 2: To Program Reading Materials

Sullivan's early programming efforts were in the area of modern languages. His decision to program reading materials came somewhat later in a fit of frustration. He had striven diligently to write programs in modern languages that would yield a very low error rate. Yet high school students simply could not master his programs. Convinced that his programs were not at fault, he concluded that the students were to blame; they could not read well enough to follow his programs. To keep the students from making his

error rates look bad, and also because he realized that there was something quite ineffective with current reading instruction, Sullivan decided to turn his programming efforts to the subject of reading.

Decision 3: To Provide for Teacher Training and Supplementary Materials

Sullivan and Calvin decided in the mid-1950's that development of programmed materials could not rely solely on the writing of programs. They realized that programming was a large-scale innovation and that it must be treated as such. A new method of teaching required a new teaching environment. Consequently, they accepted the task of not only writing programmed materials, but of restructuring the world of the classroom through teacher training and supplementary non-programmed materials. This decision eventually evolved into the complex systems approach represented by Project READ and Project LEARN.

Decision 4: To Write Program Materials Himself

Sullivan decided to write programs himself, despite the incredible tediousness of that task, rather than merely direct other programmers. This decision seems to have stemmed from his lack of faith in other people's ability. Sullivan found that most other people who tried programming simply could not do it. It required an absence of ego involvement, since each program was inevitably criticized through revision after revision. Sullivan discovered that few people besides himself could spend the long hours writing and rewriting that programming required. Consequently, he had the personal responsibility of writing and rewriting nearly everything that was done. Had he not reserved so much responsibility for himself, Sullivan most likely would not have been so exhausted with programming in 1970 that he had to face the agonizing decision of whether or not to retire from active participation.

Decision 5: To Discontinue the Use of Teaching Machines

Sullivan in 1957 decided to discontinue use of the tape recorders and more complex machines in association with the programmed texts. Sullivan states that reliance on machines had been unwise, but that it was understandable. First of all, B. F. Skinner had been machine-oriented, and

Sullivan had inherited that orientation from him along with the concept of programming. Secondly, Sullivan's own background had been with teaching machines before programming had started. Nonetheless, they discovered that the machines were too expensive, that they broke down too easily and were often inoperable, and that each program revision entailed revision of tapes as well. That the machines were merely making programming more complex finally occurred to him. Discontinuing their use was a major decision; every program had to be entirely rewritten and programming embarked on a new path. Had this decision not been made, however, it seems likely that programmed materials would never have achieved such common usage, for the cost and complexity of operation would have been prohibitive.

Decision 6: To Utilize "Chaining" Techniques

In 1958, Sullivan initiated another major format change with his invention of "chaining." Children were becoming easily bored with the tremendously repetitive format that Skinner had used and Sullivan had accepted, and one of Sullivan's chief goals was to keep children enthused and interested. To alleviate this problem, he decided not to repeat blocks of information in each frame, but to allow each frame to build on information presented earlier. Consequently, children could proceed through a program much more quickly. This decision, too, probably was vital to the success of the program. No matter how valid the theory behind programming, students would not have enjoyed working with it if Sullivan had persisted in presenting the same information over and over.

Decision 7: To Use a Vertical Format

Another major format change came about as a result of Sullivan's decision to use a vertical format rather than a horizontal one, as has been explained under Actual Development Procedures. This decision was most likely not of as great a consequence as the two previous decisions listed.

Decision 8: To Leave Hollins

In 1961, Sullivan, Calvin, Miss Buchanan, and a number of other Hollins staff members decided to leave Hollins and move to California as employees of Encyclopedia Britannica Films. They saw the move as a means of escaping

the interference of the Hollins administration with their work. Relations with EBF had up to that time been good and they anticipated more freedom to carry on their research as they wished. Deciding to work for EBF was an immediate fiasco. They found that EBF intended to impose even more restrictions than Hollins College had, and that the company's commercial orientation just could not coexist peaceably with their own academic leanings. However, leaving Hollins did break the programming staff out of their rut and did in the end lead them to set up a workable situation on their own.

Decision 9: To Form Sullivan Associates and BRL

The decision by Calvin and Sullivan in 1961 to set up their own companies was perhaps an inevitable one. They had tried and failed to work in both a university setting and a commercial setting. The only perfect setting for their unique operation would have to be one of their own making. It was this decision that yielded the very successful blend of research, development, and commercialism that characterizes the programming operation today. And, of course, had they simply given up programming at that point, this teaching method might never have progressed beyond the basic research stage.

Decision 10: To Revise the Programmed Reading Series

The decision to revise the Programmed Reading series was made in order to meet California requirements for adoption as a state-approved text. In 1966, California turned down Programmed Reading, but Sullivan Associates felt that adoption was an important enough goal to spend 18 months revising and improving the series. The revised edition met state standards, and considerable sales have resulted.

Decision 11: To Retire as President of Sullivan Associates

Sullivan's decision to retire from the presidency of Sullivan Associates was the result of considerable anguish. He felt he could not continue working at the extreme pace he had kept up for 15 years. Yet he feared that programming would die without his personal constant attention. He seemingly faced either his own collapse or the collapse of his life's work. He finally was convinced, however, that Miss Cynthia D. Buchanan was capable of carrying on both administrative and creative functions of Sullivan Associates.

The company seems as successfully productive as ever, and Sullivan seems well adjusted to the more leisurely pace of his current projects.

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APPENDIX A

RESULTS OF MOUNTAIN VIEW FIELD TEST OF PROGRAMMED READING

Data are presented under the following headings:

Table A-1 Data for Experimental Groups Using Programmed Reading and for Equated Controls

Table A-2 Individual Reading Grade Growth for Students Using Programmed Reading

Figure A-1 Evaluation of Programmed Reading With Remedials--Remedial Group vs. National Norm

Figure A-2 Evaluation of Programmed Reading in Normal Second Grade--Experimental Group vs. Control and National Norm

Figure A-3 Evaluation of Programmed Reading in Normal First Grade--Experimental Group vs. Control and National Norm

Table A-1

Data for Experimental Groups Using Programmed Reading and for Equated Controls

School Grade	Group	School	Number of Students	I.Q.		Reading Grade on Test Data						Average Total Reading Grade Growth
						Sept., 1962[1]		Jan., 1963[2]		June, 1963		
				Mean	Range	Mean	Range	Mean	Range	Mean	Range	
1[a]	Experimental	A	22	117	82-132	1.6	1.1-1.8	2.5	2.0-3.5	3.6	2.5-4.8[2,3]	2.0
1[a]	Control	A	25	126	-	1.6	--Discontinued due to biased testing--					-
1[a]	Blind Control	B	22	117	92-142	-	-	1.8	1.3-2.5	2.5	1.5-3.9[2]	0.9[4]
2[b]	Experimental	A	13	[d]		2.5	1.9-3.7	3.1	2.5-3.9	3.9	2.8-5.0[3]	1.4
2[b]	Control	A	6	[d]		2.0	1.7-2.4	2.8	2.0-3.7	2.8	2.5-3.4[3]	0.9
2-3[c]	Experimental Remedial	B	11	104	89-119	Oct., 1962[2] 1.4	0-3.2	2.7	1.8-3.4	3.7	2.2-5.5[2]	2/3

[1]Lee-Clark Reading Readiness Test -- 1962 Revision

[2]Gates Primary Tests

[3]Gates Advance Primary Tests

[4]Assuming September score same as Experimental Group

[a]Figure A-1

[b]Figure A-2

[c]Figure A-3

[d]Experimental and control groups equated for I.Q.; scores not available from school.

Table A-2

Individual Reading Grade Growth for Students Using Programmed Reading

Sept., 1962 - June, 1963
22 First Grade Students

Rank Order: Lowest to Highest	Reading Grade Placement Sept.-Oct.	Jan.	June	Total Reading Grade Growth
1	1.3	2.00	2.48	1.18
2	1.8	2.00	3.03	1.23
3	1.6	2.23	2.92	1.32
4	1.5	2.18	2.88	1.33
5	1.8	2.70	3.45	1.65
6	1.8	2.21	3.47	1.67
7	1.5	2.26	3.20	1.70
8	1.6	2.51	3.40	1.80
9	1.7	2.33	3.53	1.83
10	1.5	2.43	3.36	1.86
11	1.1	2.32	3.03	1.93
12	1.8	2.35	3.75	1.95
13	1.8	2.53	3.87	2.07
14	1.4	2.31	3.50	2.10
15	1.8	2.89	3.95	2.15
16	1.6	2.54	3.77	2.17
17	1.8	2.53	4.15	2.35
18	1.4	2.42	3.77	2.37
19	1.4	2.42	3.93	2.53
20	1.8	2.84	4.30	2.60
21	1.8	2.56	4.60	2.80
22	1.8	3.01	4.85	3.05
Mean	1.6	2.48	3.60	2.00

I.Q. Distribution	
I.Q. Interval	Frequency
80-84	1
85-89	0
90-94	0
95-99	0
100-104	1
105-109	5
110-114	2
115-119	3
120-124	1
125-129	5
130-134	4
135-139	0
140-144	0
145-149	0
Mean I.Q. - 117	

Figure A-1

Evaluation of Programmed Reading With Remedials

Remedial Group vs. National Norm

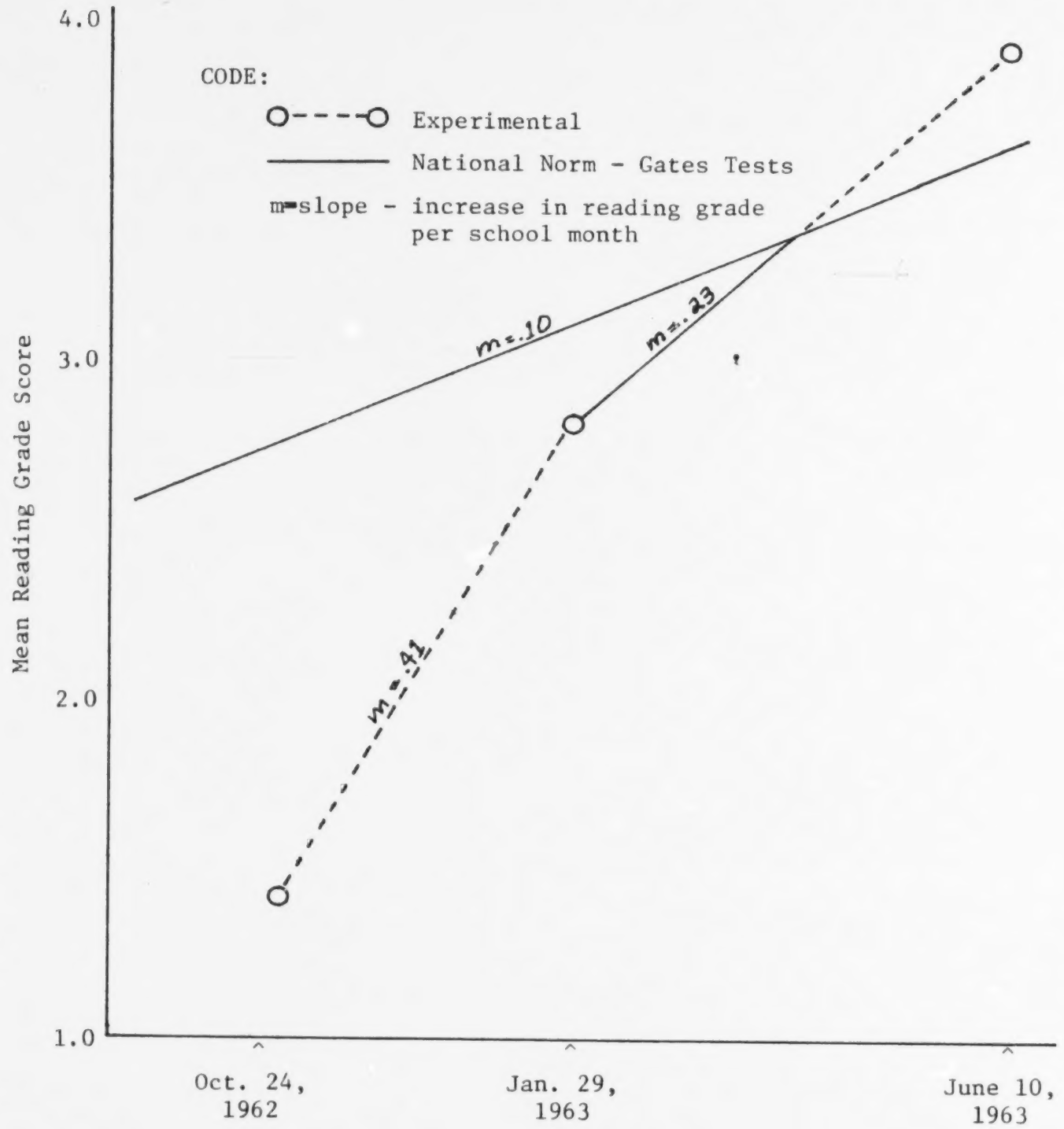
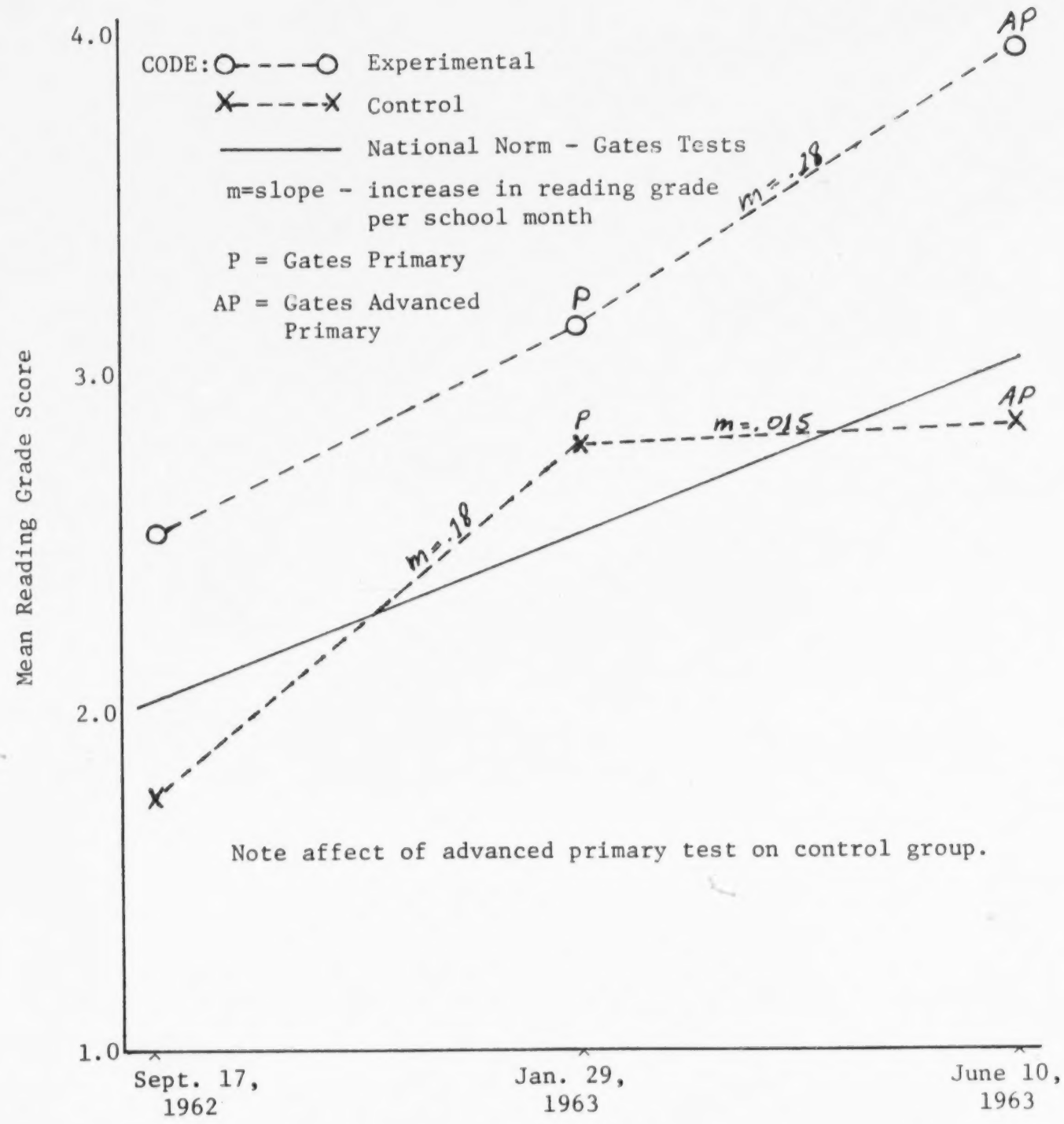


Figure A-2

Evaluation of Programmed Reading in Normal Second Grade

Experimental Group vs. Control and National Norm

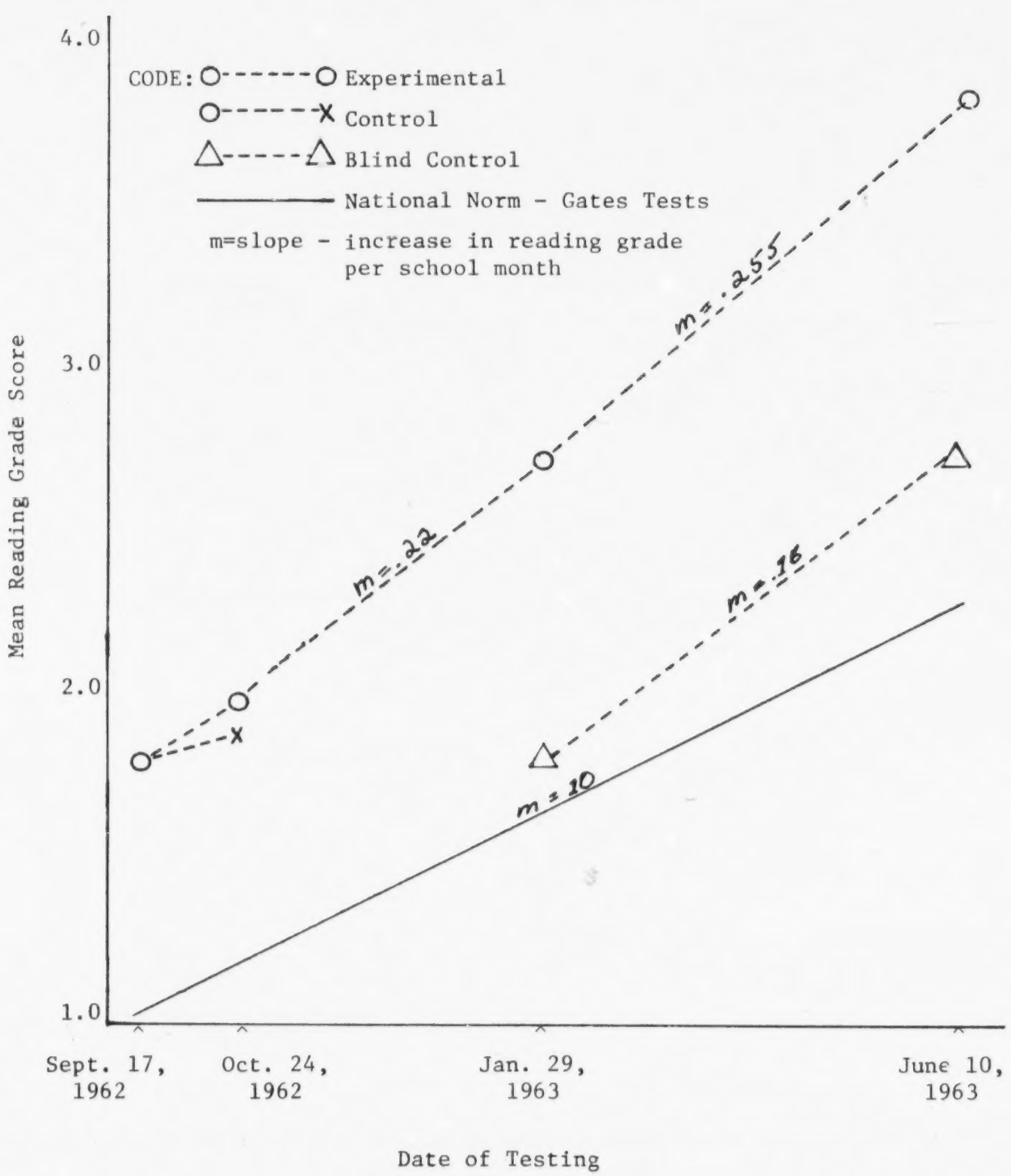


Note affect of advanced primary test on control group.

Figure A-3

Evaluation of Programmed Reading in Normal First Grade

Experimental Group vs. Control and National Norm



APPENDIX B

RESULTS OF THE SAN FRANCISCO FIELD TEST OF PROJECT READ

The Grade Sequence column is listed in terms of semesters; H1 indicates the second semester of grade 1, L5 indicates the first semester of grade 5.

Test data are presented according to three analyses.

The status (column A) is represented by the national-norm grade equivalents at the 75th, 50th, and 25th percentiles for pre- and posttest score distributions.

The gain (column B) between pre- and posttest scores was calculated for each pupil. The percent of pupils who recorded month-for-month gain is recorded. (Harold L. Weeks, Director of the Division of Research and Program Evaluation for the project, points out that generally pupils characterized by poverty do not demonstrate month-for-month gain, but fall farther behind grade level as they proceed.)

The relationship (column C) of each pupil's reading score to actual grade placement (A.G.P.) at the time of testing was classified as: (1) at or above grade placement (AGP/+); (2) .1 to .9 year below actual grade placement (-.1/.9); or (3) one year or more below actual grade placement (-1.0/+).

Standardized Test Evaluation of Project READ During School Year 1968-1969

I. PRE- AND POST-TEST STATUS AND PUPIL SCORE CHANGE FOR PROJECT READ PARTICIPANTS IN SIX ELEMENTARY GRADE SEQUENCES: STANFORD READING TEST, TOTAL READING

Grade Sequence: Test Month & Year, Test Level & Form (A.G.P. At Testing) Pre-Test	Post-Test	Elapsed Time in Years	Number of Pupils	Number of Schools	Percentile	(A) Status of Group: Grade Equivalent Pre-Test	Post-Test	Diff.	(B) Pupils Gains: % Mon.-for-Mon.	Scale in Re A.G.P. (Years)	(C) Per Cent of Pupils Pre-Test	Post-Test	Dif
	H1 May'69 P I W (1.8)		327	18	75th		1.7			AGP/+		22	
					50th		1.6			-.1/.9		78	
					25th		1.4			-1.0/+		0	
H1 May'68 P I W (1.8)	H2 May'69 P II W (2.8)	1.0	354	19	75th	1.6	2.8	+1.2	30%	AGP/+	13	26	+13
					50th	1.5	2.0	+0.5		-.1/.9	87	38	-49
					25th	1.4	1.8	+0.4		-1.0/+	0	36	+36
H2 May'68 P II W (2.8)	H3 May'69 P II X (3.8)	1.0	359	18	75th	2.7	3.7	+1.0	35%	AGP/+	23	24	+ 1
					50th	2.1	2.8	+0.7		-.1/.9	43	25	-18
					25th	1.8	2.3	+0.5		-1.0/+	34	51	+17
H3 May'68 P II X (3.8)	H4 May'69 Int.IX (4.8)	1.0	108	6	75th	3.4	4.8	+1.4	64%	AGP/+	14	27	+13
					50th	2.6	3.7	+1.1		-.1/.9	27	19	- 8
					25th	2.0	3.0	+1.0		-1.0/+	59	54	- 5
L4 May'68 P II W (4.3)	L5 May'69 Int.IX (5.3)	1.0	43	4	75th	3.2	4.5	+1.3	56%	AGP/+	2	16	+14
					50th	2.7	3.7	+1.0		-.1/.9	14	9	- 5
					25th	2.2	3.0	+0.8		-1.0/+	84	75	- 9
H4 May'68 P II Y (4.8)	H5 May'69 Int.IX (5.8)	1.0	57	3	75th	3.8	5.8	+2.0	75%	AGP/+	18	24	+ 6
					50th	3.2	4.5	+1.3		-.1/.9	5	18	+13
					25th	2.7	3.7	+1.0		-1.0/+	77	58	-19
L6 Oct'68 Int.IIW (6.1)	H6 June'69 Int.IIY (6.9)	0.8	375	9	75th	5.2	6.5	+1.3	62%	AGP/+	10	20	+10
					50th	4.2	5.1	+0.9		-.1/.9	15	13	- 2
					25th	3.5	4.2	+0.7		-1.0/+	75	67	- 8
Six Grade Sequences			1296*	27					46%	AGP/+	15	23	+ 8
										-.1/.9	43	24	-19
										-1.0/+	42	53	+11

*This total does not include the 327 grade H1 pupils for whom no gain scores were available in the absence of a pre-test.

Standardized Test Evaluation of Project READ During School Year 1968-1969

II. PRE- AND POST-TEST STATUS AND PUPIL SCORE CHANGE FOR PROJECT READ PARTICIPANTS IN SIX ELEMENTARY GRADE SEQUENCES: STANFORD READING TEST, WORD MEANING

Grade Sequence Test Month & Year Test Level & Form (A.G.P. At Testing) Pre-Test	Post-Test	Elapsed Time in Years	Number of Pupils	Schools	Percentile	(A) Status of Group: Grade Equivalent Pre-Test	Post-Test	Diff.	(B) Pupil Gains: % Mon.-for-Mon.	Scale in Re A.G.P. (Years)	(C) Per Cent of Pupils Pre-Test	Post-Test	Diff
	H1 May'69 P I W (1.8)		327	18	75th 50th 25th		1.8 1.5 1.3			AGP/+ -.1/.9 -1.0/+		27 73 0	
H1 ay'68 I W 1.8)	H2 May'69 P II W (2.8)	1.0	354	19	75th 50th 25th	1.7 1.4 1.3	2.8 2.1 1.8	+1.1 +0.7 +0.5	40%	AGP/+ -.1/.9 -1.0/+	17 83 0	25 44 31	+ 8 -39 +31
H2 ay'68 II W 2.8)	H3 May'69 P II X (3.8)	1.0	359	18	75th 50th 25th	2.8 2.1 1.8	3.8 2.9 2.3	+1.0 +0.8 +0.5	38%	AGP/+ -.1/.9 -1.0/+	25 44 31	26 26 48	+ 1 -18 +17
H3 y'68 II X .8)	H4 May'69 Int.IX (4.8)	1.0	108	6	75th 50th 25th	3.3 2.7 2.0	4.7 3.6 3.2	+1.4 +0.9 +1.2	58%	AGP/+ -.1/.9 -1.0/+	17 27 56	22 19 59	+ 5 - 8 + 3
L4 y'68 II W .3)	L5 May'69 Int.IX (5.3)	1.0	43	4	75th 50th 25th	3.3 2.8 2.5	5.2 3.7 3.1	+1.9 +0.9 +0.6	53%	AGP/+ -.1/.9 -1.0/+	2 19 79	23 12 65	+21 - 7 -14
H4 y'68 II Y .8)	H5 May'69 Int.IX (5.8)	1.0	57	3	75th 50th 25th	3.6 2.9 2.7	5.9 4.7 3.6	+2.3 +1.8 +0.9	70%	AGP/+ -.1/.9 -1.0/+	19 2 79	28 19 53	+ 9 +17 -26
6 '68 .IIW 1)	H6 June'69 Int.IIY (6.9)	0.8	375	9	75th 50th 25th	5.1 4.1 3.5	6.6 5.1 .1	+1.5 +1.0 +0.6	62%	AGP/+ -.1/.9 -1.0/+	8 14 78	25 10 65	+17 - 4 -13
Six Grade Sequences			1296* 27						49%	AGP/+ -.1/.9 -1.0/+	16 42 42	25 25 50	+ 9 -17 + 8

is total does not include the 327 grade H1 pupils for whom no gain scores were available the absence of a pre-test.

Standardized Test Evaluation of Project READ During School Year 1968-1969

III. PRE- AND POST-TEST STATUS AND PUPIL SCORE CHANGE FOR PROJECT READ PARTICIPANTS IN SIX ELEMENTARY GRADE SEQUENCES: STANFORD READING TEST, PARAGRAPH MEANING

Grade Sequence: Test Month & Year, Test Level & Form (A.G.P. At Testing) Pre-Test	Post-Test	Elapsed Time in Years	Number of Pupils	Number of Schools	Percentile	(A) Status of Group: Grade Equivalent Pre-Test	Post-Test	Diff.	(B) Pupil Gains: % Mon.-for-Mon.	Scale in Re A.G.P (Years)	(C) Per Cent of Pupils Pre-Test	Post Test	Dif
	H1 May'69 P I W (1.8)		327	18	75th		1.7			AGP/+		17	
					50th		1.5			-.1/.9		83	
					25th		1.5			-1.0/+		0	
H1 May'68 P I W (1.8)	H2 May'69 P II W (2.8)	1.0	354	19	75th	1.6	2.9	+1.3	29%	AGP/+	12	27	+15
					50th	1.5	2.0	+0.5		-.1/.9	88	34	-54
					25th	1.4	1.7	+0.3		-1.0/+	0	39	+39
H2 May'68 P II W (2.8)	H3 May'69 P II X (3.8)	1.0	359	18	75th	2.6	3.8	+1.2	40%	AGP/+	21	26	+ 5
					50th	2.0	2.9	+0.9		-.1/.9	43	25	-18
					25th	1.7	2.3	+0.6		-1.0/+	36	49	+13
H3 May'68 P II X (3.8)	H4 May'69 Int.IX (4.8)	1.0	108	6	75th	3.2	4.8	+1.6	57%	AGP/+	14	27	+13
					50th	2.6	3.9	+1.3		-.1/.9	28	26	- 2
					25th	1.9	2.9	+1.0		-1.0/+	58	47	-11
L4 May'68 P II W (4.3)	L5 May'69 Int.IX (5.3)	1.0	43	4	75th	3.1	4.6	+1.5	47%	AGP/+	9	7	- 2
					50th	2.5	3.7	+1.2		-.1/.9	9	21	+12
					25th	2.0	2.7	+0.7		-1.0/+	82	72	-10
H4 May'68 P II Y (4.8)	H5 May'69 Int.IX (5.8)	1.0	57	3	75th	4.0	6.0	+2.0	72%	AGP/+	16	26	+10
					50th	3.2	4.6	+1.4		-.1/.9	16	16	0
					25th	2.7	3.7	+1.0		-1.0/+	68	58	-10
L6 Oct'68 Int.IIW (6.1)	H6 June'69 Int.IIY (6.9)	0.8	375	9	75th	5.4	6.6	+1.2	56%	AGP/+	15	21	+ 6
					50th	4.2	5.0	+0.8		-.1/.9	13	12	- 1
					25th	3.4	4.2	+0.8		-1.0/+	72	67	- 5
Six Grade Sequences			1296*	27					45%	AGP/+	16	24	+ 8
										-.1/.9	43	23	-20
										-1.0/+	41	53	+12

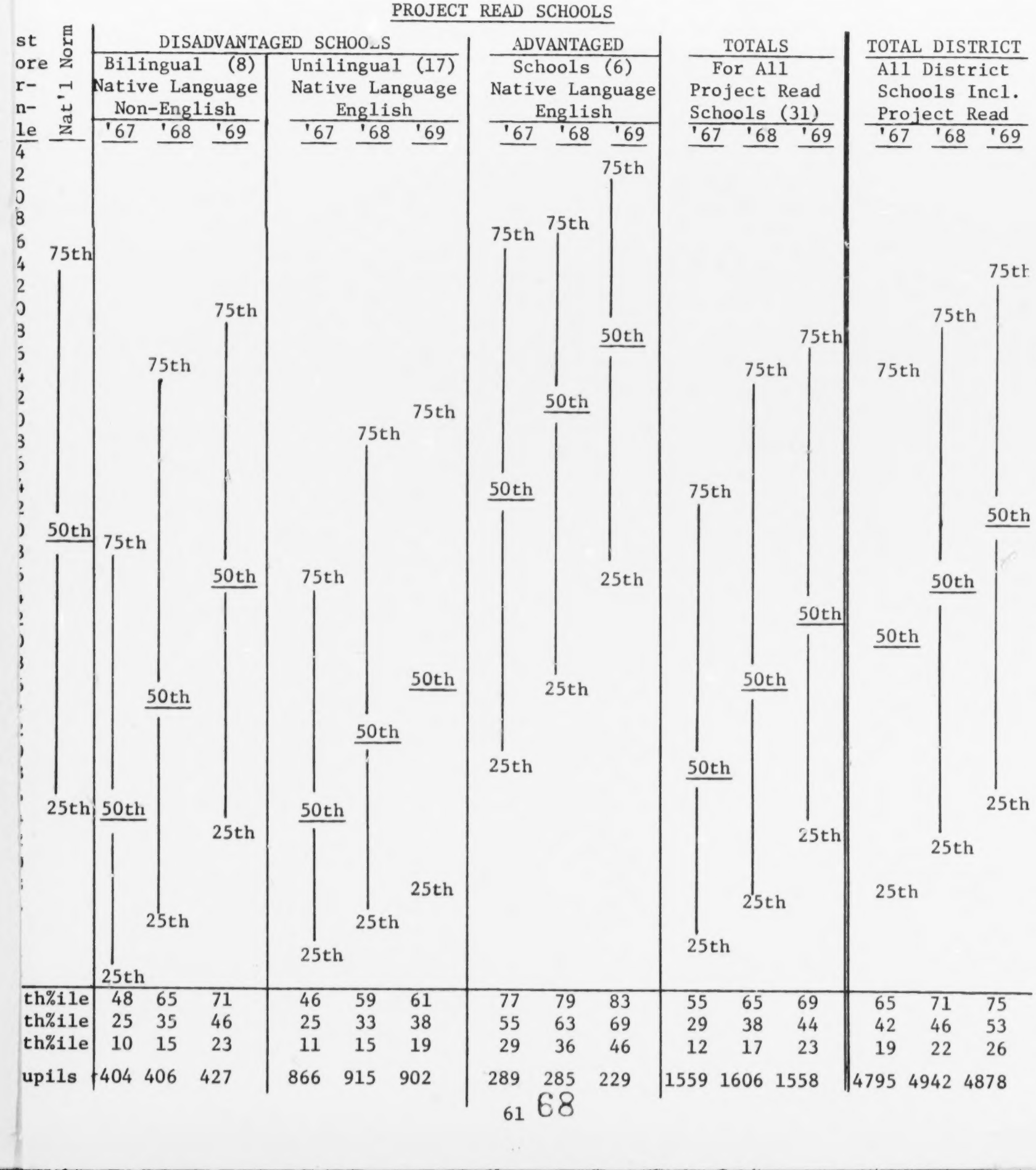
*This total does not include the 327 grade H1 pupils for whom no gain scores were available in the absence of a pre-test.

THREE-YEAR COMPARISON OF READING READINESS STATUS AT END OF KINDERGARTEN,
FOR PROJECT READ SCHOOLS AND ALL DISTRICT SCHOOLS

1967 - Precedes Introduction of Project Read
1968 - Includes Eight-Week Pilot of Project Read, March-May
1969 - Includes First Complete Year of Project Read

Metropolitan Readiness Test, Form A, Given in Late May or Early September
(Test Score Percentile Equivalents Based on Publisher's Standardization Norms
on Which the "Typical" Pupil Ranked at 50th Percentile)

PROJECT READ SCHOOLS



APPENDIX C

SELECTED BIBLIOGRAPHY OF DR. ALLEN D. CALVIN

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APPENDIX D

LIST OF PRODUCTS AND DEVELOPERS

The following is a list of products for which Product Development Reports will be prepared.

1. Arithmetic Proficiency Training Program (APTP)
   Developer: Science Research Associates

2. CLG Drug Education Program
   Developer: Creative Learning Group
   Cambridge, Massachusetts

3. Cluster Concept Program
   Developer: Dr. Donald Maley and Dr. Walter Mietus
   University of Maryland

4. Developmental Economic Education Program (DEEP)
   Developer: Joint Council on Economic Education

5. DISTAR
   Developer: Siegfried Engelmann & Associates

6. Facilitating Inquiry in the Classroom
   Developer: Northwest Regional Educational
   Laboratory

7. First Year Communication Skills Program
   Developer: Southwest Regional Laboratory for
   Educational Research & Development

8. Frostig Perceptual-Motor Skills Program
   Developer: Dr. Marianne Frostig

9. Hawaii English Program
   Developer: Hawaii State Department of Education
   and the University of Hawaii

10. Holt Social Studies Curriculum
    Developer: Dr. Edwin Fenton
    Carnegie Education Center
    Carnegie-Mellon University

11. Individually Prescribed Instruction--Math
    Developer: Learning Research and Development Center,
    University of Pittsburgh

12. Intermediate Science Curriculum Study
    Developer: Florida State University
    Dr. Ernest Burkman

13. MATCH--Materials and Activities for Teachers and Children
    Developer: The Children's Museum
    Boston, Massachusetts

14. Project PLAN
    Developer: Dr. John C. Flanagan and the
    American Institutes for Research

15. Science: A Process Approach
    Developer: American Association for the Advancement
    of Science, Commission on Science Education

16. Science Curriculum Improvement Study
    Developer: Dr. Robert Karplus, Director
    University of California, Berkeley

17. Sesame Street
    Developer: Children's Television Workshop

18. Sullivan Reading Program
    Developer: Dr. M. L. Sullivan

19. Taba Curriculum Development Project
    Developer: San Francisco State College

20. Talking Typewriter
    Developer: Omar K. Moore and Responsive
    Environments Corporation

21. Variable Modular Scheduling
    Developer: Stanford University and
    Educational Coordinates